TRANSACTIONS

of the

THIRTY-EIGHTH NORTH AMERICAN WILDLIFE AND NATURAL RESOURCES CONFERENCE

Conference Theme:
NATURAL RESOURCES AND NATIONAL PRIORITIES

MARCH 18, 19, 20, and 21, 1973

Washington Hilton Hotel

Washington, D. C.

Edited by
James B. Trefethen

Published by the
WILDLIFE MANAGEMENT INSTITUTE
WIRE BUILDING
WASHINGTON, D. C. 20005
1973

Additional copies may be procured from
WILDLIFE MANAGEMENT INSTITUTE
Wire Building, Washington, D. C. 20005
for $8.50 Postpaid.

PRINTED IN
U.S.A.
by
MP GRAPHICS
Baltimore, Md.

WILDLIFE MANAGEMENT INSTITUTE

OFFICERS

DANIEL A. POOLE, *President*
L. R. JAHN, *Vice-President*
H. L. HAMPTON, JR., *Treasurer*

Program Committee

L. R. JAHN, *Chairman*

TERRY A. MCGOWAN, *Vice-Chairman*
Representing THE WILDLIFE SOCIETY

ENRIQUE BELTRAN, *Director*
Instituto Mexicano de Recursos Naturales Renovables, Mexico City, Mexico

STEWART M. BRANDBORG, *Executive Director*
The Wilderness Society, Washington, D. C.

EDWIN L. COOPER, *Past President*
American Fisheries Society, University Park, Pennsylvania

FRANK C. DANIEL, *Secretary*
National Rifle Association of America, Washington, D. C.

JOSEPH L. FISHER, *President*
Resources For The Future, Washington, D. C.

HARDIN R. GLASCOCK, JR., *Executive Secretary*
Society of American Foresters, Washington, D. C.

KENNETH E. GRANT, *Administrator*
U.S. Soil Conservation Service, Washington, D. C.

C. R. GUTERMUTH, *President*
World Wildlife Fund, Washington, D. C.

GEORGE B. HARTZOG, JR., *Past Director*
National Park Service, Washington, D. C.

G. DOUGLAS HOFE, JR., *Past Director*
U.S. Bureau of Outdoor Recreation, Washington, D. C.

SYDNEY HOWE, *President*
The Conservation Foundation, Washington, D. C.

RAYMOND C. HUBLEY, JR., *Executive Director*
Izaak Walton League of America, Arlington, Virginia

BODIE MCDOWELL, *Past President*
Outdoor Writers Association of America, Greensboro, N. C.

JOHN R. MCGUIRE, *Chief*
U.S. Forest Service, Washington, D. C.

RUSSELL MCKEE, *Past President*
American Association for Conservation Information, Lansing, Michigan

RUSS J. NEUGEBAUER, *Former Executive Vice President (Dec.)*
Int'l. Ass'n. of Game, Fish and Conservation Commissioners, Washington, D. C.

TONY J. PETERLE, *President*
The Wildlife Society, Columbus, Ohio

H. WAYNE PRITCHARD, *Director*
Soil Conservation Society of America, Ankeny, Iowa

DWIGHT F. RETTIE, *Executive Director*
National Recreation and Park Association, Arlington, Virginia

BURTON W. SILCOCK, *Director*
U.S. Bureau of Land Management, Washington, D. C.

ANTHONY WAYNE SMITH, *President*
National Parks and Conservation Association, Washington, D. C.

SPENCER H. SMITH, *Director*
U.S. Bureau of Sport Fisheries and Wildlife, Washington, D. C.

SPENCER M. SMITH, *Secretary*
Citizens Committee on Natural Resources, Washington, D. C.

ELVIS J. STAHR, *President*
National Audubon Society, New York, New York

RICHARD H. STROUD, *Executive Vice President*
Sport Fishing Institute, Washington, D. C.

JOHN S. TENER, *Director*
Canadian Wildlife Service, Ottawa, Ontario

WILLIAM E. TOWELL, *Executive Vice President*
American Forestry Association, Washington, D. C.

RUSSELL E. TRAIN, *Chairman*
Council On Environmental Quality, Washington, D. C.

W. LLOYD TUPLING, *Conservation Representative*
Sierra Club, Washington, D. C.

BERNARDO VILLA R., *Past Director General*
De la Fauna Sivestre, Subsecretaria Forestal y de la Fauna, Mexico City, Mexico

N. A. WINTER, JR., *President*
National Wildlife Federation, Phoenix, Arizona

ROBERT WINTHROP, *President*
North American Wildlife Foundation, New York, New York

EVERETT M. WOODMAN, *President*
The Nature Conservancy, Arlington, Virginia

GORDON K. ZIMMERMAN, *Executive Secretary*
Nat'l Ass'n. of Conservation Districts, Washington, D. C.

Ladies Committee

Mrs. Daniel A. Poole Mrs. Laurence R. Jahn Mrs. Terry A. McGowan

The Wildlife Management Institute expresses its appreciation to The Wildlife Society and the many organizations and individuals who contributed to the success of the Thirty-eighth North American Wildlife and Natural Resources Conference.

CONTENTS

PART I

OPENING GENERAL SESSION

THE WHITE HOUSE

WASHINGTON

March 14, 1973

It is a pleasure to welcome to our Nation's Capital the delegates to the Thirty-Eighth North American Wildlife and Natural Resources Conference.

I warmly commend the initiative and foresight that are so amply reflected in the agenda of your meeting and that so aptly carry forward today's pressing need to preserve the finite natural resources of our continent. Your participation in these sessions is a major catalyst in educating your fellow citizens on the necessity of environmental protection and preservation.

The United States is proud to be in the vanguard of international projects for a cleaner and better planet; and such initiatives as the World Heritage Trust, the National Park idea, the efforts to conclude a convention on endangered species and other bilateral studies can be of deepest satisfaction to our citizens.

Never has there been such a need for the kind of leadership and expertise that the participants in this meeting continue to bring to these endeavors. I applaud you, and I wish you Godspeed in your important plans toward a Bicentennial Resources Convention during the celebration of our nation's two hundredth birthday.

Richard Nixon

GENERAL SESSION

Monday Morning—March 19

Chairman: SYDNEY HOWE
President, The Conservation Foundation, Washington, D. C.

Vice Chairman: JOHN F. HOSNER
Professor, Virginia Polytechnic Institute and State University, Blacksburg

ACTIONS NEEDED TO BENEFIT RESOURCES AND PEOPLE

FORMAL OPENING

DANIEL A. POOLE

President, Wildlife Management Institute, Washington, D. C.

Welcome to the 38th North American Wildlife and Natural Resources Conference.

The Conference theme—Natural Resources and National Priorities—was not selected deliberately to capitalize on the current Washington crossfire over executive and legislative prerogatives. The theme was chosen many months ago, but its timing could not be better.

The interest of conservationists, environmentalists, resource specialists, and their allies—in short, of all of us—is caught up in the President's argument with Congress, or the Congress' argument with the President, or however one happens to see it. The outcome will contribute little to our mutual interest if it fails to produce procedures for establishing priorities and assuring their sustained support.

Environmental renovation, enhancement, and protection will continue to be piecemeal without fundamental reform. This is unavoidable because both the executive and legislative branches lack policies and procedures to assure coordinated response to environmental and conservation needs and opportunities. This is not said in criticism of

any individual, of Congress, or of the Administration. It is a fact of life to anyone who has served an apprenticeship in the nation's capital.

Executive agencies lack comprehensive, long-term environmental objectives. Most have scant understanding of what is expected of them in terms of a coordinated, national approach. Their inclination is to ride out their luck in four-year strings, to react to conservation and environmental problems and opportunities in terms of single agency missions. This sometimes involves the process of wetting one's finger, testing the political wind, and riding off in a favorable direction. The environmental impact statement process, although still being refined, has helped to broaden the agencies' environmental horizons. Much obviously remains to be done.

This piecemeal approach is encouraged by the situation in Congress where committee jurisdictions lack the flexibility to encourage an ecological approach to resources and environmental management. Authorizations and appropriations are handled by separate committees, and the members of each rarely have equal grasp of the purpose, need and relative importance of program elements. And, in the absence of national environmental priorities, both lack a yardstick for evaluating programs and budget requests. The functional structure of Congress contributes to the irregular and sometimes adversary consideration of environmental and conservation issues.

Standing squarely between the agencies and Congress is the Office of Management and Budget, where largely inaccessible persons, acting for the Administration, cut and shape programs to an economic template entirely of their own. When there are budget constraints, as there are this year, OMB's cutting and fitting challenge environmental credulity. Budgeteering treats only of dollars. It forces programs to conform to fund ceilings, a physical division of the pie. But it requires no tough-minded analysis and justification of programs for which money is requested. If it did, we would not be faced with continued substantial federal encouragement of environmental degradation, as will be the case in the coming fiscal year.

Of the fourteen listed major budget categories for fiscal year 1974, the natural resources and the environment function is in next to last place, tied with international affairs and finance in its percentage claim of the federal dollar. And nearly half of the money in the natural resources and the environment account is allocated for water resources and power, activities that do not always get high marks in the conservation and environmental marketplace. There are some pluses in the agriculture and rural development account, but two-thirds of the funds requested there are for farm income stabilization. Little is for protecting the basic soil and water base.

Some of these issues may be sharpened in Wednesday's General Session when the Assistant Director of the Office of Management and Budget addresses the subject of justifying budget priorities. Other speakers will explore federal and state agency organization in respect to establishing priorities in resource management.

These are important and timely subjects, for it is becoming increasingly clear that environmental goals cannot be achieved readily by more of today's hit-or-miss approaches. Our recognition of the need for a better response exceeds our current capability to attain it.

Resources and environmental programs cannot be turned on and off like a water tap. They are long term and continuing in nature. They should be buffered from the vandalism of short-term expedience. Successful discharge of environmental responsibility requires a factual data base, determination of priorities, coordinated planning, and professional execution. Adequate and continuing funding is needed at every level to see programs through to their stated objectives.

If one accepts the thesis that national outlay over time should bear a relationship to national income, then serious questions can be raised about budget constraints in fiscal year 1974. Will available money be invested in programs that contribute to greatest environmental gain? I think not. The same question holds for those who may suggest that government perennially can run in the red. No amount of money will get the environmental job done if it is squandered, rather than invested.

Without better definition of priorities there is no rationale for understanding either an Administration's budget requests or a Congress' actions on appropriations. Until priorities are determined and firmly established, we lack a means for measuring progress. What actually is being achieved in terms of the environment as a whole?

In his recent environmental message to Congress, President Nixon said, "It is appropriate that this topic be the first of our substantive policy discussions in the State of the Union presentation, since nowhere in our national affairs do we have more gratifying progress, no more urgent problems."

The President enumerated substantive legislation in the areas of air and water quality, pesticides control, noise abatement and ocean dumping, coastal zoning, the National Environmental Policy Act, parks, recreation areas, wildlife refuges and wilderness, and regulations regarding oil and other spills in ports and waterways.

The record is impressive. But is the progress that has been made more in the laying of a foundation than in erecting a building? The boards and nails and wiring for environmental reconstruction largely are missing. Funds are not being sought to finance new activities at

anywhere near projected levels. Old projects are withering on the vine. The outlook for fiscal 1975 is equally dim. If progress is being made against the tide of environmental deterioration, it mainly may be in standing still, in not being swept away.

For example, the most recent report on fish kills by pollution, an annual service report begun in 1960 and issued by the Environmental Protection Agency, advises that "The number of fish reported killed by pollution in 1971 is greater by 81 percent than the number reported in any previous year on record. The data do not indicate whether this is due to better reporting by a concerned public or to greater fish kills."

Contrast that ambivalent conclusion with the more recently released results of a statewide water pollution survey by Maryland Health and Natural Resources agencies. There, one-third of the 128 sewage treatment plants presently are not complying with the state's anti-pollution laws. One-fifth of nearly 900 businesses known to discharge industrial waste do not meet the state's water quality regulations. State and federal installations are among the violators.

In his message, the President recommended many new programs for managing the land, for improving agriculture, controlling pollution, and protecting our natural heritage. Some, like a national land-use policy, control over the siting of power plants, public lands management, mining and mineral leasing reform, mined area protection, and endangered species protection, are vital. Others, like adjustment of land and water conservation fund allocations, are highly controversial. Controversial, too, are administrative decisions which are directing more and more of the limited outdoor recreation money into metropolitan situations and uses to which the land and water conservation fund never was intended. Abolition of the open space grants of the Department of Housing and Urban Development places even greater pressure on the fund. And in face of all of this, appropriations to the fund would be greatly reduced under the 1974 budget requests. Despite great need, the money cannot be fully used, we are told. Incredibly, hundreds of millions of dollars of land acquisitions are going unserviced in new park and recreation area authorizations. And older, established areas, including wilderness, are splotched with incompatible inholdings and developments. Senate oversight hearings will be held on this subject in early April.

Some question the breaking of new ground if older, equally fertile, and already broken ground remains unseeded. There is reason to ask if new authorities will receive any stronger support than older and equally needed authorities are receiving today. To continue with this environmental roulette may impart a sense of motion, certainly not an

unwelcome illusion in our political system, but will it help the train get away from the station?

My remarks, to some, may sound unduly pessimistic or critical. They are not offered in that vein. Many elements of our environmental fix have their origins in the distant past. I do not imply either that today's leaders are unmindful of the many contradictions and inadequacies. My purpose is not to throw stones. Instead, it is to express the hope and to urge that our people's concern for their environment not be dissipated on frivolous or superficial things. Let's insist that their energies and enthusiasms be used in ways and places to overcome entrenched impediments to substantial environmental gain.

Among the most reliable barometers of the state of the environment are fish and wildlife. Man's use of water, soil, air and plants has a direct influence on the distribution, diversity, and abundance of these habitat-dependent creatures.

Tomorrow morning at a special session, Dr. Durward L. Allen of Purdue University will set before this Conference a new North American Wildlife Policy report, the second but much broader focus on this subject. The Conference program has been arranged to enable all conferees to attend and participate in the discussion. Everyone who has registered already has received a copy of the report.

The Conference is deeply indebted to Durward and to the members of his working and honorary committees. Theirs has been a labor of devotion. An undertaking of this magnitude takes many hours out of the busy schedules of the committee's chairman and its members. But Durward and his associates believe their assignment to hold the greatest urgency, for the sole previous policy, with its sound advice, was published more than four decades ago.

Certainly, it is unrealistic to presume that all parts of the 1973 wildlife policy report will receive unanimous agreement. But there is acute need to refocus professional and public thinking and action. In fact, the welcome but sometimes misguided public enthusiasm for wildlife today suggests that our profession has been negligent in keeping the public acquainted with the necessity for and the positive aspects of all facets of wildlife management.

The report undoubtedly will be the subject of much discussion in coming months. Perhaps it may be possible to give further consideration to these policy matters at the 1976 Conference here in Washington. A joint bicentennial observation of our interest in resource conservation is being planned by major conservation and professional groups that year.

A final point about wildlife concern. Under this country's leader-

ship, and with fine support from friends Russ Train, Nat Reed, and others, a convention has been concluded on world traffic in endangered and threatened species. It also importantly commits nations to uphold the conservation laws of other countries—an international application of the Lacey Act, in effect.

The convention also stipulates that the secretariat, which will be placed in the U.N. environmental program, shall convene occasional wildlife meetings. The U.S. 1969 Endangered Species Act also authorizes the Secretary of the Interior to provide technical assistance to nations desiring such help.

Last fall, I attended three international meetings—that of the IUCN, the Second World Parks Conference, and the 7th World Forestry Congress—at which individuals with substantial wildlife interest were in attendance. Some penetrating questions were asked, particularly by representatives from developing nations where wildlife and their habitat are under extreme pressure from population expansion and economic development. At no meeting did these questions receive adequate attention or answers. Program schedules did not permit it, and, in some cases, the required expertise was not available. The result is that development and habitat alteration are proceeding with minimum or no consideration for either flora or fauna.

Perhaps the time is at hand to convene a world wildlife conference, a conference that treats of animals and their habitats as distinct entities rather than adjuncts of other but not-well-focused social and resource considerations. The interest of wildlife demands the attention of the wildlife profession, and much more is involved than biological and ecological considerations.

* * * *

A luncheon for visiting ladies will be held at noon today in the Lincoln West room on the Concourse floor. Ladies wishing to be the Institute's guest should obtain required tickets from the conference registration desk promptly. Because of changed hotel procedures, it has been necessary to set an early limit on the number of tickets for the ladies luncheon, as well as for The Wildlife Society's Annual Dinner on Monday evening and the Conference Banquet on Tuesday evening.

The Conference Banquet tickets are on sale at the registration desk. In keeping with long practice, The Wildlife Society's Leopold Medal honoree will be announced at the banquet. There will be no speeches, and a musical show will climax the evening.

REMARKS OF THE CHAIRMAN

SYDNEY HOWE

My job this morning is to introduce the various speakers and I must confess that whenever I think of introductions I think of Dan Poole.

Dan and I once sat together at the annual banquet of one of the nation's well known bird and conservation societies. We were seated at the head table listening to a magnificient introduction of one of the nation's great bird authorities and artists and, as the eloquent chairman waxed enthusiastically higher in appreciation of this great authority, Dan Poole turned to me and said—"I don't care what he says, the sonofagun still can't fly."

All of our speakers today, while they cannot fly, nevertheless, are very good at many other difficult pursuits.

Before proceeding, I want to present Dr. John F. Hosner, who will be your guide and inspiration in the discussion period that will follow each of our speakers. Dr. Hosner is director of the Division of Forestry and Wildlife Resources at the Virginia Polytechnic Institute and State University at Blacksburg. He has had a long career in professional forestry and wildlife work.

In several years of attending this annual conference, I have observed that the chairman of the opening session invariably assumes an opportunity to say some things that are on his mind. Such opening remarks always come under the guise of setting a tone and a framework for what is to follow. And while the chairman unburdens himself, members of the audience await, with a kind of semi-tolerant impatience, the all-star cast that they actually came to hear.

Perhaps some of you were hoping that my next words would be "Not this time." But I am not going to let down the traditionalists among you. So, on with the finest customs of the North American Wildlife and Natural Resources Conference!

We are here to discuss "Actions Needed to Benefit Resources and People." In my view we, as natural resource professionals and environmentialists, now face our greatest challenge in the benefit-to-people element of that theme.

In both professional and volunteer capacities, we and our antecedants in this field have striven long and hard, both individually and together, to purvey the "ecological view," the concepts of interdependent natural systems and of carrying capacities; and now at last, our own efforts, combined with increasingly plain evidence of the systematic disruption we have decried, have elevated these concerns to national and world awareness.

Public policy and action finally have begun—and I emphasize "begun"—to face up to man's trangressions against his habitat. However, as our society and others move, hopefully, toward the real correction of pollution, the sound control of land use, and the selective guidance of development and growth, we conservationists are forced into public-interest responsibilities for which we may not have bargained. Let me illustrate.

So we know that energy production and consumption degrade air, land and water. We may feel that today's environmental upset in the energy and auto industries "could not have happened to a nicer bunch of guys," as the saying goes, for their evasion of environmental responsibility became chronic, until their responsibility was shoved down their throats. But I submit that we cannot leave things there. Such great accomplishments as the National Environmental Policy Act and the amended Air and Water Quality Act, among others, could be lost if we fail, now, as they face their toughtest tests, to demonstrate their enduring benefits to all Americans. Familiar ways of industrial, public and personal habit for all kinds of people, not just our cozy environmental constituencies, are affected by these strong laws. If we really mean to change things by maintaining the strength that has been won and building upon it, we must go beyond our accustomed ways.

We must aggressively advance compatible practices of living and livelihood; we must promote positive means of economic uplift for those in the worst environments, and we must illuminate special qualities of life that are enriched by less, rather than more, consumption.

We know that much of the suburban development still practiced in this country wastes land and destroys natural values needlessly. But should we continue to allow the environmental ethic that we have generated to be raised in opposition to suburban housing for low-income people, as their employment moves to the suburbs?

The development impact of each housing unit for a wealthy family certainly will be much greater than the impact of each unit built for a poor family, a fact which acre-zoning hardly reflects. Also, I need not suggest who in our society needs environmental improvement the most. The point is that our professions are just the ones to get into these suburban standoffs and pave the way for landscape integrity with social responsibility.

So, we know that careless technology may be the greatest threat to the natural and human environments of developing nations and to our one spaceship, Earth. But are we ready, I would ask you, to apply the political clout of environmental awareness at home to the

funding of generous development assistance that is environmentally sound? I doubt that we are.

The international focus of our causes and our professions is mainly upon the earth's wild places and spectacular species. This is noble and important work, but I submit that it is doomed to fail unless we lend our weight and competence to the rapid improvement of degraded human environments. Throughout much of the world, hungry and distressed people will overwhelm wild nature if their essential life needs are not met.

Well, the thoughts I have just advanced pose more of a challenge than a solution. Fortunately, we have before us today a rich selection of the nation's in fact, the world's, highest expertise in the application of environmental knowledge to the mainstream of human affairs. I am sure we shall gain from these gentlemen new wisdom for the pursuit of our respective missions, as well as insights into the progress and needs of our broader collective mission at home and abroad.

It is now my pleasure to get on with the show.

Our first speaker is Maurice F. Strong.

Just three months ago, by action of the United Nations Assembly, Mr. Strong became executive director of the brand new Environment Program. Mr. Strong is a Canadian from Manitoba. He has had a very wide and varied career, including living for a year with Eskimos in the Arctic and serving as a visiting professor at York University in Toronto.

He has held a number of positions in the field of finance and natural resource development in Western Canada. In 1962, he joined one of Canada's largest investment corporations, the Power Corporation of Canada, and quickly became its president. In 1966, he resigned from all business positions and became director of the Canadian International Development Agency. He has been an alternate governor of the World Bank and held principal responsibility for Canada's participation in the United Nations Development Program.

In 1970, Mr. Strong left the Canadian government to become Secretary-General of the United Nations Conference on the Human Environment and the rest is very important modern history.

Maurice, we thank you for the massive talent and energy that you are bringing to our planet's welfare and we are honored to have you lead off this Conference to tell us about the United Nations and the environment.

* * *

SCIENCE AND SOCIETY IN THE AGE OF ENVIRONMENT

MAURICE F. STRONG
Executive Director, United Nations Environment Programme, Geneva, Switzerland

I am delighted to be with you today and to have this opportunity of addressing the participants at this 38th North American Wildlife and Natural Resources Conference.

My pleasure in being here, I should add, is all the greater because I have come to know so many of you professionally and personally during the more than two years since I became Secretary-General of the United Nations Conference on the Human Environment and more recently Executive Director of the new United Nations Environment Programme. It would be difficult for me to overemphasize how much the success of the Conference owes to the advice and support that it received from you individually and from the organizations that you represent.

In speaking to you today, I would remind you that since the word "environment" became impressed on the public consciousness, it has been used and misused within the context of the revolutions through which mankind is now living—exploding population, galloping urbanization that concentrates and deepens every impact of people on their environment, soaring energy consumption as an index of the steadily increasing material claims, uses, wastes and effluents of the new technological order, and all the associated upheavals in mankind's expectations and ways of life.

But this is precisely why you are here, and your program for the next few days examines many of the major factors that are involved. With your permission, therefore, I would like to depart a bit—but not entirely—from a discussion of the environmental implications of the Stockholm Conference as such and take advantage of the galaxy of environmental leadership gathered in this room to focus on what I believe may well be one of the most important of these implications—that the future role of science in its relationship to society as a whole. In doing so, I must emphasize that Stockholm was not a scientific conference; it was a political conference, one that operated at the critical interface between science and politics.

There was a significant participation by scientists—indeed, most recommendations were based upon the vast array of inputs assembled during the preparatory period comprising probably the most extensive compendium of scientific knowledge and opinion that has ever been brought together for a world conference of policy-makers. Nonetheless, it was clearly a conference of political decision-makers designed to produce important political decisions.

To those of you familiar with the fields concerned, little of the scientific input to the Conference represented new knowledge as such. What was new about it, though, was the fact that, for the first time, scientific truths about the environmental condition of man and society engaged the attention of political leaders on a world scale. And new, too, was the fact that so many phenomena that had previously been viewed primarily from the limited perspective of a particular discipline or set of objectives were placed in the much larger context of their relation to the multitude of other elements that make up the complex system of cause-and-effect relationships on which human life on this planet depends.

The immediate importance of the Stockholm Conference, therefore, may well be that it marked the first time that the nations of the world collectively acknowledged that something had gone wrong with the way in which man had been managing his own development, that this was already creating serious problems in many areas, and that it pointed up doubts and risks which could effect the fate of the entire human species. But the long-range importance of Stockholm will be seen in the kind of actions to which it gives rise in changing the perceptions, the attitudes and the practices which are responsible for the present dilemma.

What is the true nature of this dilemma? How serious are the environmental problems that have only so recently attracted such widespread concern, and what should we be doing about them? These are the basic questions that were at the heart of the Conference.

The Conference pointed up dramatically that environmental deterioration is already causing widespread damage. In the developing countries, for example, it is depriving people already hard-pressed to eke out a living of large quantities of irreplaceable soil, impairing the benefits they may derive from exploiting their own natural resources and use of scarce financial resources. In the industrialized countries, it is robbing people of many of the fruits of the economic growth they have been pursuing with such zeal.

To the burgeoning millions who live in the world's cities, it has meant an ominous deterioration in the quality of life, and the people of rich and poor nations alike share the risks to the oceans, atmosphere and other elements in the life systems on which our survival and well-being depend.

As you so well know, scientists themselves are divided in their opinion as to the degree and immediacy of the risks we face. But is it necessary to admit the inevitability of doomsday to accept its possibility?

To accept the prophecies of doom that are increasingly heard today

would be to assure their fulfilment. But the promise of Stockholm is that it is possible not only to avoid catastrophe but to build the kind of future in which all people will have access to the ingredients of a better, richer, more satisfying life. The ultimate test of the success or failure of the Conference is the extent to which it helps bring about this kind of world.

It gave us a solid base on which to build, and as you know, on the basis of the Conference recommendations, the U.N. General Assembly at its last session approved the United Nations Environment Programme which we are now in the process of organizing. At the heart of the UNEP will be the far-ranging Action Plan for the Human Environment that also came out of Stockholm. It consists of 109 recommendations for specific kinds of actions to be taken principally by governments and international organizations, many of them requiring extensive participation and complementary supporting action from nongovernmental organizations and citizens groups.

An examination of the recommendations comprising the Action Plan demonstrates clearly, however, that we cannot hope to carry it out effectively without the full cooperation and involvement of the scientific community. But I am convinced that this cooperation cannot be achieved without substantial changes within the scientific community itself and its relationships with society. And I am convinced, furthermore, that herein is to be found one of the most important of all the environmental implications of the Stockholm Conference.

Science is the key to both the unparalleled promise and peril which today confronts mankind. It is entirely true, of course, that science and scientists can no more be blamed for the problems and the threats that have accompanied the creation of what is, in effect, the world's first technological civilization, than they can be given full credit for the manifest benefits it has produced. But neither can they validly claim the political innocence they sometimes profess.

To a much greater extent than they like to admit, scientists have always been dependent upon patronage for the pursuit of their professional activities. And equally to a greater extent than they would like to admit, the direction and nature of their work have been influenced by the interests and requirements of the patrons who have provided the resources for it.

Today, the great patrons of science are the state and business and industry, particularly the giant corporations. Thus, it should not be surprising that the principal emphasis of science—the areas receiving the greatest attention and attracting the largest number of scientists—are those which serve the interests of these powerful patrons. Not at all surprising, too, is the concentration of scientific effort on the

development of sophisticated weaponry and defense systems, space and areas related to the development and exploitation of resources, and the production and distribution of consumer products.

As science and technology are the keys to the power by which we are shaping our future in the new society, it is obvious that there must be a large-scale re-orientation in the priorities of science and a massive redeployment of our scientific and technological capabilities. And so it is important that scientists themselves take a much greater part in the process by which the priorities of science for the environmental era are determined.

One result of the present situation is that the specialized and often narrow objectives of the patrons in their uses of science and the increasing degree of professional specialization within the scientific community itself have together contributed to a narrowing of the concerns and the perspectives of scientists. This is reflected in the compartmentalization within universities and research institutions and the often poor communication amongst scientists of different disciplines.

Perhaps here is an explanation of what happened in the case of our environmental problems and it suggests why we were so slow in perceiving many of the dangers, understanding their nature, and taking remedial action.

It can be argued, of course, that the magnitude of contaminating effluents has only recently exceeded the levels beyond which ecosystems are unable to assimilate them and only recently has man acquired the scientific tools with which to perceive and understand the consequences. Also, societal values vary. What may be considered environmental degradation in one area or period of time, may not be so regarded in another.

It must also be noted that it is not just the scientific institution but nearly all our institutions—national and international—that are organized by sector or discipline. And that it is in the sphere of sectoral decision-making and action that such simple tests as profitability—often short term—form the basis for embarking upon an activity which may impose severe, long-term costs on the public and may produce adverse effects that are outside the sector originating action.

Business and industry, for example, define their objectives and measure their accomplishments in terms of return on investment; universities and professional associations are organized around particular disciplines and fields of study; governments have largely been organized around functional ministries and agencies, and their counterparts in the inter-governmental organizations have been similarly

structured. Very much the same has also been true of non-governmental organizations, most of which are organized around a relatively narrow field of interests and concerns. And in virtually all cases the characteristic form or organization is hierarchical, the power flowing from the top down.

This form of organization worked well in the past, and facilitated the rapid and even spectacular progress made in so many fields of human endeavor. But it also makes it difficult to perceive—and even more difficult to deal with—complex environmental cause and effect relationships that transcend traditional disciplinary and institutional boundaries.

For the inescapable fact is the environment cannot be sectoralized. It is a system of interacting relationships that extends through all sectors of activity, and to manage these relationships requires a series of horizontal linkages for which present institutional structures are inadequate. The answer to the question of what happened in the case of our environmental problems is that they arose in large measure from the failure—the inability—of traditional institutions to assess and take responsibility for the overall effects of a variety of activities, especially when these fell outside their area of responsibility.

If the present environmental crisis results—as I believe it does—from gross inadequacies in the processes by which society takes major decisions which, in turn, influence its own future, then I believe this is due in large part to the inadequacies to which I have referred in the inter-faces between science and the decision-making processes of society. I do not think it conceivable that we can achieve the physical, economic and social balances on which the continued health of our society must be based without radical improvements in the way which the relationships operate at this interface.

Here, I believe, are important tasks which can best be performed at the international level, at which there are often possibilities of a more free association of scientists beyond some of the immediate constraints which may limit the possibilities for effective expression at the national level. There can be several advantages to this.

My contact with scientists in developing countries also persuades me that one of the most important advantages of an international professional body is that it helps endow the scientist in countries which lack a sophisticated scientific infrastructure and tradition—and in which scientists are small in number and often starved of resources—with the professional status and recognition which is so important to their work. This is particularly true in those disciplines that may seem a step removed from the immediately perceived economic and military interests of their country.

And still another advantage that will have increasing importance in the environmental area is that so many of the major issues and concerns that will be facing us in the future will be international in nature, and to deal with them there must be an increasing degree of internationalization of the organizations of science.

In its work, the Wildlife Management Institute—and indeed this Conference—exemplifies that much progress in this direction has been made. But I know from experience in trying to enlist the support of the international scientific community in preparation for the Stockholm Conference the great limitations under which international scientific bodies operate—their paucity of resources, the difficulty of obtaining full participation in their work, particularly by scientists from developing countries.

It is not that a high degree of centralization is needed. That would be both impractical and undesirable. But international bodies must have sufficient resources to provide the essential linkages and channels of communication within their own professional community throughout the world, between their particular professional discipline and other branches of science, and with the international organizations at the governmental level to which their own professional activities are related.

I believe that such improved organization at the international level would strengthen the various branches of science in each country, would improve both the effectiveness and the image of the scientific community as a whole, and facilitate the kind of close working relationships that will be necessary if man is to successfully deal with the major imbalances which the environmental crisis has pointed up.

The scientist's role in the new United Nations Environment Programme must be seen in the overall context of Stockholm and its aftermath. Indeed, it is my hope and intent that the UNEP will develop the very closest links with all scientists, and that the Action Plan recommendations will be carried out in large part in active cooperation with the international scientific community.

Let me mention just a few of the particular areas arising out of the Action Plan which will involve such close cooperation.

1. The "Earthwatch," or environmental assessment program, involving research and monitoring on a global scale on a number of important environmental parameters and the assessment of potential risks, their sources and consequences. It is a cooperative program based largely on the work of existing scientific and research institutions at the national level, as well as at that of the relevant international organizations. In particular it will be directed to detecting and forecasting possible consequences of

changes in the oceans, atmosphere, major ecological systems and the food chain which may have an important bearing on man's own well-being;

2. A massive attack on the problems of soil erosion and degradation, including surveys of soil capabilities and degradation hazards;
3. A number of measures involving the environmental effects of mineral and energy use and production;
4. A comprehensive study of available energy resources, new technologies most effective development of the world's energy resources;
5. Arrangements for the systematic audit of national resources development projects in representatives ecosystems of international significance;
6. The development of methods for the integrated planning and management of natural resources in accordance with the particular environmental circumstances of each country;
7. Measures to encourage the further development of remote sensing techniques for resource surveys and arrangements for the international utilization of these techniques.

So, as the environmental crisis begins to bring home to people of the world and their leaders their dependence on the natural systems which nourish and sustain our lives, the unitary nature of these systems—and the extent to which man's activities can now affect them decisively—man increasingly must look to the science which has given him this awesome power to help him to control and use it wisely.

We must face the sobering reality that while this power can indeed destroy us no less through a nuclear holocaust than through the insidious, spreading cancer of uncontrolled and misdirected growth, it also gives us the power and promise to create wholly new dimensions of richness and variety and opportunities for all the world's people.

This surely is the ultimate challenge to man—for the power to destroy and the power to create are now in his hands. And even as the Stockholm Conference helped to place this crisis in its proper perspective, so does it provide a hopeful basis for forging the new relationships between science and society which will be required to deal with it.

And let's face it—this will require significant and rapid change in the attitudes of scientists and in the organization of the scientific community itself. You cannot blame all the initiative for change on society as such. The voice of science must be strong and it must be heard. The aim must be an *active* position and not merely an acquiescent servant in shaping the new society. It is not necessary to

politicize science to make it more sensitive to political and social realities. But it must shed the myth of political innocence.

Your own interest in these larger issues and the opportunity that you have given me to express my views concerning them encourage me to be optimistic concerning your response.

You are familiar, I am sure, with Einstein's expression of faith that he could not believe God plays dice with the Universe. But men do, and the scientists among you, knowing better than most the issues at stake, have a special responsibility to lead the way in helping the people of the world gamble no longer as conquerors, exploiters and plunderers of our planet, but to have the faith they need to be wise stewards and managers of its generous but threatened resources, of its resilient but not indestructible systems that support all life.

If you can help stir this faith, you will help build—and make secure—a world in which succeeding generations of man can look to the future with hope and confidence.

DISCUSSION

VICE CHAIRMAN HOSNER: Thank you, Maurice, for those very fine remarks. Does anyone have a question to ask Mr. Strong?

MR. WALTER B. SMALLEY: First I want to thank Mr. Strong for his comments. Do you think that the other countries, particularly Germany and Japan, which we helped put on their feet after World War II, are they going to carry their weight in the future? I think this is a great problem in an economic way.

DR. STRONG: Well, I can only tell you, Mr. Smalley, that both Germany and Japan have taken a very active interest at the international level in the environmental program. As an index of that, let me say that Japan has pledged ten million dollars, ten percent of the new environmental fund, which is a pretty good, hard indication of their interest and commitment.

Germany has made a pledge which, if extrapolated over a five-year period, puts it on a comparable basis to Japan, because their amount is approximately the same.

I should also remind you that we are not talking about a commitment of funds for foreign aid. What we are talking about is a commitment to make it possible for all those countries in the world, regardless of their financial capability, to participate in the kind of environmental action which is not only to their good but which is necessary if our own domestic programs are going to be effective.

Therefore, it is not a matter of assistance but a matter of creating a program in which participation of these countries is absolutely vital for the success of our own efforts and where some funds are needed to make this participation possible.

MR. SCOTT PORTER: Based on my studies over the past two years, I have felt that development of the environment is not only applicable to regions of the developing world but that there are many regions in the United States, such as Appalachia, the Indian community and other areas, where the problems are not only those of overdevelopment but are basically air and water problems of underdevelopment and unemployment.

Now, how fast can we, as individuals, move from a dimension of looking at the aspects of the natural environment to one that deals with total human development? Appalachia, for example, deals with strip mining, not only as an impact on the environment but as an impact to technology, which, according to statistics, has been removing jobs from that area. This, in turn, has resulted in individuals having to move out of the region and into urban areas where,

as a consequence, they are less able to get jobs and less able to live in the environment in natural ways.

I think that is of real relevance to the environment perspective. We do not have to look for developing countries to discuss this and it is time we got on with it. Therefore, Mr. Strong, I would like to ask how we can tie our own individual efforts into this channel.

DR. STRONG: The relationship between environmental concern and the concerns of the developing world for their own development were, of course, central to the Stockholm Conference.

Mr. Porter has made some very good points in raising his question. However, let me simply say that when we first talked to the developing countries about environment they were not interested in anything called "environment"—they were interested and continue to be interested in their own development and many of their own problems which they increasingly described as problems in relation to poverty and underdevelopment and not the kind of development processes which have created the problems we are dealing with here.

We are dealing mainly with by-products of processes of urbanization and industrialization that have created our wealth. They must deal with problems of underdevelopment. They do have some of the same problems, particularly in their cities, that we do.

The cities of the developing world are experiencing virtually the same kinds of problems our cities do and they have to accommodate much larger rates of urban growth, larger than we have ever experienced. Further, they have to deal with it on a much smaller resource base.

However, in addition, developing countries have to deal with such basic problems as soil management. I understand that the developing countries lose, every year, more capital in present worth terms by erosion of soil than they receive in all forms of foreign aid put together, especially at a time when they have more mouths to feed and greater demand for better food.

Therefore, the problems with respect to water quality in the cities of the world are massive, not only in relation to contamination from normal industrial wastes but from natural contamination that they experience in these tropical areas. There also are problems of forestry management and of wildlife management. All of these problems of environmental management are increasingly becoming, to the developing world, a key to their very own existence, to their own prospects for the future. Therefore in relation to these developing countries, the management of their basic environmental capability is the key to their development.

To answer your question specifically, of what we can do—what we can do is to understand that this problem is really part of a global environmental problem; to help support the creation of a network of institutions, of a network approach to action which engages the resources of institutions and organizations like this of the industrialized country in the kind of program that will permit these countries not only to participate but to receive the benefit of the latest technology and the latest techniques in dealing with their problems; to support for the creation of that kind of global network and to realize that the support is based not just on traditional concepts of charity but on absolute necessity to protect our own environment; and to join in protecting the vital resources of the developing world.

* * *

THE NATIONAL ENVIRONMENTAL POLICY ACT STATUS AND ACCOMPLISHMENTS

LYNTON K. CALDWELL
Professor of Public and Environmental Affairs, and Arthur F. Bentley Professor of Political Science, Indiana University, Bloomington, Indiana

In the closing hours of the 91st Congress a new set of national priorities was adopted for the United States. Enactment of Public Law 91-190, the National Environmental Policy Act of 1969, made explicit, for the first time in American history, a broad national commitment to the human environment. Although the legislation had no precedent, it occasioned little debate. Its implications were generally unforeseen and its significance was underestimated by friends and future opponents alike. At least by law, a major innovation in national priorities had occurred, but only the most perceptive observers perceived its meaning.

As the impact of the Act has been felt, it has drawn sharply differing reactions. It has been described as "revolutionary," "sophisticated," "atrocious," and "all-embracing." There has been general agreement that it has been effective, but not all critics subscribe to the same criterion of effectiveness. From the viewpoint of tradition-minded engineers, fiscal officers, lawyers, and mission-directed administrators, NEPA has been effective in generating costly delays, mountains of paper work, and irresponsible interference in the conduct of agency business. But ecologically-oriented citizens have seen the Act as a Magna Carta of environmental protection and a cornerstone of a new era in the responsible exercise of public power.

There is more than one way to evaluate the effectiveness of NEPA, but no evaluation can be adequate that does not measure the accomplishments of the Act *in relation to its purpose.* The legislative history of NEPA should make its purpose clear; the documentary record is comprehensive and explicit. The Act should be read as a redirecting of national priorities with particular reference to the responsibilities of the National Government. NEPA has offended the conventional assumptions of many legalists and technicians, but the Act was not intended to accommodate conventional licensing and regulatory procedures. It was intended to modify fundamentally the basis of Executive decision-making on matters affecting the quality of the environment; legal technicalities of regulatory procedure were to accommodate its policy objectives—not vice versa.

The drafters of the Act knew that the agencies would not willingly

alter their established policies and programs, nor voluntarily take measures to comply with the intent of the Act. Action-forcing provisions were necessary if the new priorities set forth in the Act were to be realized in practice. Enactment of this law, unwanted by the Executive Branch and unknown to the public generally, was the achievement of an initial victory in a larger struggle to reorder national priorities. How enduring and how significant this victory may be belongs to the subject-matter of future history.

THE ACT SHOULD BE EVALUATED IN ITS COHERENT TOTALITY

To judge the merits of legislation solely by what it has accomplished may be useful, but may also be misleading. This risk is present when agencies responsible for the administration of a law, by indifference or intent, fail to utilize fully its potentialities. The danger also exists when the administration of a law, for whatever reason, is imbalanced in relation to its substance and intended application.

Both of these dangers must be taken into account in any adequate evaluation of NEPA. The potentialities of the Act exceed its applications thus far, and attention has been focused on its principal action-forcing provision, the five-point environmental impact statement, to the neglect of equally important policy directives. The ultimate effectiveness of the Act is being threatened by underemphasis on its intended ends and overemphasis on one of several means to those ends. This is not to say that the ends of NEPA are being sacrificed to its means. The educative, procedure-reforming, and action-forcing values of the Section 102 impact statement greatly overweigh the evident misuse and abuse of this innovative provision. But to understand and appreciate the significance of NEPA, the Statute must be viewed in its entirety as a coherent and operational statement of public policy.

NEPA undertakes to do three things, each of which is clearly delineated in the text of the legislation. *First,* the Act declares a national policy for the environment. *Second,* it directs the agencies of the Federal Government as to how this policy is to be put into practice and provides procedures for making its directives enforceable. *Third,* it provides institutional arrangements in the Council on Environmental Quality for supervising the administration of the Act and in the President's Environmental Quality Report for assessing the extent to which its objectives are being accomplished. The Act is a highly coherent piece of legislation; its various provisions are mutually reinforcing. In the hands of an administration determined and able to achieve a high-quality environment for all Americans within the ascertainable future, NEPA could be a powerful instrument. In fact,

the commitment of the Executive Branch and the independent agencies to the stated objectives of the Act appears to be ambivalent. Nor is the Congress free from inconsistency; it has never jettisoned the "pork barrel" in the interest of environmental quality. Achievements under the Act owe as much to judicial enforcement as to administrative initiative, or to the integrity of the Congress, in honoring its own declared principles.

THE INTERRELATED PROVISIONS OF THE ACT

The declaratory provisions of the Act are found in the section entitled "Preface" and under Title I, Section 101, "Declaration of National Environmental Policy." These provisions are intended to make explicit the objectives of a national policy for the environment. They are necessarily general in character but are as concrete as would be wise for long-range guidelines to policy. For example, Section 101 declares that ". . . it is the responsibility of the Federal Government to use all practicable means, consistent with other essential considerations of national policy, to improve and coordinate Federal plans, functions, programs, and resources to the end that the Nation may—

1. fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
2. assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings;
3. attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;
4. preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity and variety of individual choice;
5. achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and
6. enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources."

This set of objectives is, of course, qualified by the phrase ". . . consistent with other essential considerations of national policy. . . ." The President and the federal agencies are not instructed where to place environmental objectives on a scale of national priorities. And yet the six points, and the declaration generally, afford minimal guidelines for national action. They specifically require the inclusion of environmental quality in the priorities of the federal agencies and make action to realize these priorities a federal responsibility. All

other sections of the Act should be read with Section 101 in view. All other provisions of the Act are intended to implement the Declaratory Statement.

The Environmental Impact Statement. Sections 102 and 103 are instructions to the federal agencies as to how the Congressional intent is to be realized through administrative action. For reasons presently to be considered, attention has been focused inordinately upon Section 102 (C), the five-point environmental impact statement requirement. This provision is perhaps the most innovative, and certainly the most controversial, feature of the Act.

The almost obsessive anxiety in some federal agencies over the 102 statement requirement has led to a number of unfortunate misconstructions. Two are especially important. *First,* is the notion that NEPA is primarily a procedural statute rather than a fundamental reconstruction of national priorities. *Second,* is the opinion that the impact statement is a costly and capricious burden upon the normal business of government rather than the logical outcome of the procedural instructions of the Congress to the federal agencies pursuant to the declaration of national policy.

Complaints about the costs, delays, and uncertainties of 102 impact statement procedures are not fairly leveled against the Act. They are largely consequences of three interacting factors: the unwillingness of the agencies to modify and redirect their missions in accordance with the preceding sections of the Act, the tendency of lawyers to emphasize procedure over policy, and reluctance of the Executive, through the Office of Management and Budget, or by other means, to "persuade" the agencies to take seriously the declaration of policy and guidelines for program planning made explicit in the preceding sections of the Act.

It was not the intention of the drafters of NEPA to impose a huge burden of paper work upon the agencies, and the Act does not do so. The impact statement was required to force the agencies to take the Act seriously, and to consider the environmental policy directives of the Congress in the formulation of agency plans and procedures. Although exceptional cases may be distinguished, the primary cause of the alleged burden of the 102 statement is the attempt of agencies to manipulate the requirement so as to justify procedurally projects substantively inconsistent with the purpose of the Act. As a cynic might put it, some federal agencies have been employing lawyers and environmental consultants to turn mission-oriented sows' ears into ecological silk purses.

There are constructive effects in the agencies however. Observers of 102 statement procedures have stated that increased interdepart-

mental communication has prompted cooperative interagency action in planning, and that agency planners are developing a greater awareness of environmental factors and greater sophistication in building ecological consideration into agency thinking. There have also been failures in agency response and perhaps even collusion among agencies in frustrating "Environmentalist" attacks. But the constructive effects appear to be the more significant.

The drafters of NEPA had no naïve illusions as to the readiness of the agencies to comply with the intent of the Act. It was assumed that the agencies would be readier to employ 102 procedures to protect their missions, programs, and projects from modification on behalf of environmental quality. There could be no certainty as to the willingness of the Executive to enforce compliance with the Act. An alternative to Executive enforcement was therefore provided in opening the decision-processes of the agencies on environmental issues to public scrutiny by reference to the Public Information Act (Section 552 of Title 5, United States Code).

The effectiveness of this provision was greatly enhanced by related and parallel developments—the rapid rise of public interest law suits, the modification of traditional rules regarding standing-to-sue, and judicial interpretation of the 102 impact statement to impose more than a merely procedural requirement. The judgment of courts in placing the impact statement requirements within the substantive policy context of NEPA defeated agency hopes of turning 102 procedures into more legal rituals. In addition, one of the most plausible recourses for agency defense was cut off by Section 103.

The Neglected Section 103 Statement. The conventional response of many federal administrators to complaints regarding the environmental impact of agency actions has been to place the blame on Congress. The damming, dredging, draining, irrigating, airport building, highway building, clear-cutting, predator poisoning, pesticide spraying activities of government have been defended as mandated by the Congress. In these and other actions with potentially adverse environmental impacts the agency defense has been that "We're just doing what Congress told us to do." But there have been 93 Congresses since the Constitution was adopted. Some agencies are acting under mandates laid down by Congressmen long departed from this Earth. For example, a Congressional mandate of 1872 has for more than a century given the exploration and exploitation of minerals a position preeminent over environmental considerations. Accordingly, Section 103 of NEPA required all federal agencies to ". . . review their present statutory authority, administrative regulations, and current policies and procedures for the purpose of determin-

ing whether there are any deficiencies or inconsistencies therein which prohibit full compliance with the purposes and provisions of this Act."

Section 103 required all agencies to propose to the President ". . . such measures as may be necessary to bring their authority and policies into conformity with the intent, purposes and procedures set forth in this Act." Unfortunately, because the agencies were required by law to report to the President by July 1, 1971 (the actual date was qualified by administrative action), this section has been assumed to have a one-time applicability. As might have been expected, few agencies found anything in their statutory authority, regulations, or policies that they would propose to change. As a corrective, Section 103 appeared to be ineffectual, but it could embarrass agency attempts to avoid compliance with NEPA on grounds of conflicting mandates. It seems probable that the conflicting authority argument could be successfully invoked only if the incompatible agency mandate were accorded a higher priority than the environmental considerations involved. Agency logic would be to argue that the "other essential considerations of national policy" in Section 101 would justify any incompatibility between their missions and NEPA.

The Council on Environmental Quality. Title I establishes policies and procedures; Title II provides institutional implementation through the President's Annual Environmental Quality Report and the Council on Environmental Quality. The Report is in fact prepared by the C.E.Q. The power and duties of the C.E.Q. are specified in eight paragraphs, some of which, if backed by the President and supported by adequate funds, could be powerful tools of policy. Their exercise might, however, arouse displeasure in the Congress and in the mission-oriented agencies affected.

For example, Section 204, Paragraph (3) declares it the duty and function of C.E.Q. ". . . to review and appraise the various programs and activities of the Federal Government in the light of the policy set forth in Title I of this Act for the purpose of determining the extent to which such programs and activities are contributing to the achievement of such policy, and to make recommendations to the President with respect thereto. . . ." Obviously, the extent to which this provision is implemented is a matter of political judgment and discretion as well as of material facts. How far the C.E.Q. can effectively move toward implementing this provision is difficult to say. Much depends upon the commitment of the President to the objectives of NEPA in relation to other priorities.

Closely related is Paragraph (4) authorizing the C.E.Q. ". . . to develop and recommend to the President national policies to foster and promote the improvement of environmental quality to meet the

conservation, social, economic, health, and other requirements and goals of the Nation. . . ." Here again, the effectiveness of the C.E.Q. depends very largely upon the interest and receptivity of the President. The Council has made recommendations that, on a few occasions, have gone beyond policy preferences in "the White House." The President's fiscal program has also been an ever-present constraint.

Paragraphs (5) and (6) are vestigial provisions from the Gaylord Nelson Ecological Survey and Research Bill from which NEPA in part developed. Under (5), the C.E.Q. is authorized ". . . to conduct investigations, studies, surveys research and analyses relating to ecological systems and environmental quality." Paragraph (6) provides authority ". . . to document and define changes in the natural environment . . . and to accumulate necessary data and other information for a continuing analysis of these changes or trends and an interpretation of their underlying causes." When these provisions are supplemented by Section 205 (2) directing the C.E.Q. ". . . to utilize to the fullest extent possible, the services, facilities, and information . . . of public and private agencies and organizations and individuals . . . ," it seems clear that by law the C.E.Q. could become a major institution for the stimulating, funding, and coordinating of ecological and environmental research.

The implementation of these provisions is less dependent on the priorities and preferences of the President than are other functions of the C.E.Q. They are statutory duties of the C.E.Q., and the Congress could fund the Council to carry them out at any level upon which the Congress and the President might agree. Conceivably the C.E.Q. could administer a multi-billion dollar effort in ecological research and environmental monitoring and data gathering. The M.I.T.-Club of Rome Study on *The Limits to Growth* could have, under the rationale of Section 204, been sponsored and funded by the C.E.Q. But there are, in the broad sense, political difficulties in an agency in the Executive Office of the President becoming a major source of funding for research and development.

It may also be argued that implementation of these provisions is unnecessary because the functions are being performed by other organizations such as the National Science Foundation, the Environmental Protection Agency, the National Oceanic and Atmospheric Administration, and the National Institutes of Health. But, in relation to the need, funding for environmental research has not been given high priority. Most of the available money appears to have been allocated to specialized and technical aspects of, for example, pollution. Policy-oriented, synthesizing studies receive little encouragement or support from any source. The aborted attempt to create a

government-sponsored, but independent, institute of environmental policy studies was one possible answer to the charges given to the C.E.Q. under Sections 204 and 205. Alternative possibilities do not appear to have been considered, at least in public. The degree of political and scientific consensus on the need to implement these sections more extensively does not seem sufficient to obtain action. Nevertheless, NEPA provides a means for fact-finding and research that is available to the Congress and the President whenever their evaluation of the importance of the functions it might perform prompts them to use it.

A review of experience under NEPA thus far indicates that judges rather than administrators have become the principal interpreters of the Act, and that Section 102 impact statement procedures have become a preoccupying concern of its critics. To understand these developments, the Act must be viewed within the context of politics in the United States at the beginning of the nineteen seventies. Obviously only the most relevant aspects of this context can be considered here.

THE POLITICS OF PRIORITIES

No generalization is without its exceptions, but the effectiveness of legislation depends as much upon the political environment in which it is applied as upon its substance and intended effect. NEPA implies a major modification and even a reversal of long established priorities in the political economy of the Nation. The disruptive effects of the Act on the business-as-usual economy do not appear to have been foreseen by the Congress or by those interests most likely to have been affected. However, the weekly news magazine *Time* observed, in its issue of August 1, 1969, that if NEPA became law, its impact might be felt by ". . . every imaginable special interest—airlines, highway builders, mining companies, real estate developers. . . ." and all federal policies with environmental implications would be open to challenge.

The prevailing assumptions of business and politics have not been favorable to a vigorous or comprehensive effort to realize the objectives of NEPA. There is a general national commitment to private enterprise as the principal agent of economic growth and development. This commitment tends to be poorly defined and indiscriminate. It has been reinforced by moral conviction, often with highly emotional content. Conservative and liberal opinion differs primarily over how the benefits of the enterprise system should be divided. The American way has been to seek solutions to public problems through distributive manipulation of benefits and costs, usually through the medium of money.

No major political party has shown interest in enlarging the direct managerial role of government at any political level.

The costs of a serious effort to restore and maintain the quality of the American environment appear to be greater than the present political and economic leaders of the nation seem willing to agree upon. Public opinion surveys indicate a general willingness to pay higher taxes specifically for environmental improvement, and the 92nd Congress passed the $25 billion water pollution control bill over the veto of the President. But there is also evidence to suggest that many civic and business leaders give environmental quality lower priority than do perhaps a majority of their constituents. This should not be surprising, however, for this largely middle-aged leadership rose to prominence under the very circumstances that have led to massive environmental deterioration. Their assumptions and values were largely formed in the economic depression of the nineteen thirties; their conventional yardstick for measuring the quality of life has been individual purchasing power. Thus a priorities gap may be widening between the traditional leaders in American business and politics and growing numbers of their constituencies.

SHIFTING THE RESPONSIBILITY

The primary commitment of the political economy has been to full employment and to economic growth through private business enterprise. Therefore, popular and desirable environmental policies that retard, reduce, or redirect economic activity present public officials with disagreeable alternatives. Whatever course they take, there will be trouble with some sector of their constituencies. But neither the environmental issues, their economic implications, nor the alternative solutions to the resulting problems are clearly definable. Because of their complexity, there is an area of uncertainty surrounding nearly all environmental issues. And this uncertainty offers the politician and the administrator a way to evade the cross-fire of environmental disputes. The way is to transfer responsibility for decision-making to another political jurisdiction. For the federal Executive and Congress, the courts and the states are the obvious places to shift responsibility.

This time-tested method for diffusing a burden of difficult and contentious issues lends itself to another method of high-level response to priority conflict. This is the practice of symbolic politics—an art that has been progressively perfected at the Presidential level under the administrations of Presidents Kennedy, Johnson, and Nixon. Political symbolism should not necessarily be equated with insincerity. It may or may not be joined to effective action. But

symbolic acts are often performed to provide the appearance of action without incurring its actual risks.

SYMBOLIC RITUAL OR SUBSTANTIVE REALIZATION?

The ceremonial signing of NEPA by President Nixon at San Clemente on January 1, 1970 is a perfect illustration of the technique of political symbolism. The President had not favored enactment of the legislation, preferring to deal with environmental issues through a cabinet-level council created by Executive Order. Unable to forestall Congressional action, and sensing a rising tide of popularity, Richard Nixon adopted NEPA as if it had been his own, issued a strong Executive Order to implement its execution, and appointed a Council of Environmental Quality of unquestioned distinction. It would be unfair to suggest that the response of the Nixon Administration to NEPA has been largely symbolic. It has taken as effective action on behalf of environmental quality as any preceding administration, but its acts have sometimes seemed inconsistent and evasive. The pertinent question is not: "Has the Administration been responsive to NEPA?" It is rather: "Has its response been adequate to the purpose of the Act and to the needs of the Nation?"

Adequate and realistic evaluation of NEPA must therefore consider the Act as a whole. It must consider its potential, as well as what has actually been accomplished under its administration. It must avoid an unbalanced preoccupation with any single aspect of the legislation (such as the impact statement procedure) detached from other aspects of the coherent act. Finally, it must recognize that no statute can be self-actualizing. Criticism of the text of an Act may legitimately be directed toward provisions that may defeat, distort, or otherwise negate full realization of its purpose. But beyond this, an estimate of the effectiveness of an Act entails a judgment upon those whose responsibility it is to translate policy intent into operational fact. In the case of NEPA, those most responsible are the Congress and the President. But the Judiciary and the public also share in the responsibility and have been as active in implementation of the Act as have the political branches of government.

Reviews of the Act by several committees of the 92nd Congress brought forth no major proposals for amendment. But the integrity of the Act has been threatened by several proposed amendments to exempt certain agency procedures from its jurisdiction. The most important and controversial case is, curiously, whether the principal federal regulatory agency for environmental quality, the Environmental Protection Agency, is required to conform to Section 102 environmental impact statement procedures.

The issues involved in this controversy go beyond an assessment of

the effectiveness of NEPA except in two important respects. *First,* the exemption of EPA from the 102 requirement could set precedent for a general erosion of the action-forcing provisions of the Statute. Second, criticism of NEPA as inadequate because of its lack of specific, detailed, and unequivocal criteria for regulatory action misconstrue the Act and the relationship between policy and administration.

NEPA is an operational declaration of national policy, not a regulatory statute. Its purpose is to make explicit a reordering of national priorities to accord with the changing values and perceptions of the American people. It cannot amend the Constitution to compel the President to use its directives and action-forcing provisions in any particular way. Nor can it cause the Congress to activate more fully the potentialities of the Act through supplementary legislation and more generous funding.

NEPA is no substitute for more detailed legislation governing environmental pollution, land-use planning, wildlife protection, and the quality of urban life. Its strength lies in its general character and in its focus upon broad outcomes of public action affecting the quality of the human environment. It is a statesman's law and is not, in the narrow sense, a lawyer's law. Judicial interpretations have generally recognized this distinction and have conceded to NEPA the fundamental and comprehensive character that its drafters and many of those who voted for it intended. To paraphrase a famous remark of Benjamin Franklin on the adoption of the Constitution of 1789 by the Convention in Philadelphia: the 91st Congress has given the nation a basic charter for protection of its environment; it is now the responsibility of the American people and their representatives in succeeding Congresses to keep it, and to learn to use it wisely.

A NOTE ON REFERENCES

There is now an extensive literature on NEPA and its implementation. Most of it is focused on the 102 environmental impact statement requirement. It is not feasible to list here even a representative sample of these studies. One of the best surveys of NEPA has been proposed by Wallace D. Bowman of the Congressional Research Service as Section IV (Chapter 28) of *Congress and the Nation's Environment* [Committee Print Ser. No. 87-101] Senate Committee on Interior and Insular Affairs (February 1973). A comprehensive listing of government documents and legal commentary pertaining to NEPA is appended.

DISCUSSION

MR. LANNY REED: I am with an engineering consulting firm which has been responsible for the preparing impact statements and my question involves the fact many of these statements, in the past, have not been comprehensive and the data have not been of the quality that is warranted to test projects.

How can this group assist the consulting firms in keeping their professional expertise to where it should be in the preparation of these statements?

DR. CALDWELL: The environmental statement writing procedure, I see as an exercise in learning, in education. Certainly there have been some very shabby jobs. There have also been some jobs that have been inordinately detailed far beyond what was necessary to arrive at an equitable assessment of environmental impact.

It would have been astonishing if, in the first two years of the administration of this Act, we learned how these statements would be prepared. We have been asking the agencies to look at things that they have never looked at before. The country has a shortage of people really qualified to address themselves to many of these questions and then, as Mr. Strong so well put it earlier, many of these environmental impacts can only be analyzed and assessed on an interdisciplinary basis. Our traditional ways in the government have not equipped us to bring together the kinds of teams that should be utilized in assessing environmental impact.

Now, I think the procedure is forcing the kind of consideration that it was intended to force but, certainly, in the early years of experience with it, we were bound to get a wide range of inadequacies. However, in time, we will find the right level of detail and quality which will be accepted at least as a kind of norm throughout the federal service.

NATIONAL LAND-USE POLICY: STATUS AND NEEDS

RUSSELL E. TRAIN

Chairman, Council on Environmental Quality, Washington, D. C.

I appreciate the opportunity to be here today to discuss the importance of land-use issues as they relate to all of our on-going efforts to improve the quality of the environment.

Land use used to be viewed as a problem of limited concern. Today we realize that land-use issues lie at the heart of many of the most critical environmental decisions facing the nation, whether they be air quality implementation plans, decisions on where to locate large-scale energy facilities, policies for use in our public lands, how best to manage the national parks and forests, seasonal home subdivisions in the mountains and along the coasts, or problems of urban encroachment on valuable natural areas. In short, land use has developed as our most serious environmental problem in the Seventies.

There are a number of reasons for this worth mentioning. First, land-use issues are often very complex and need to rely on value judgments related to acceptable degrees of development and acceptable levels of mitigation of adverse impacts. Often the effects of land-use decisions are widespread throughout the range of environmental concerns, including pollution, crowding, loss of wildlife and natural cover, and nearly any other issue you can think of; in short, land-use issues require an extraordinary degree of understanding of system interrelationships and ecological balance.

Second, the job of institution-building for better land use involves

the difficult task of reforming an existing and complicated structure of often overlapping, often fragmented decision processes. With air and water pollution and some other areas of environmental concern, the job was easier because there was little in the way of public agencies to deal with. When we look at land use, however, we encounter an often mind-boggling array of decision bodies, each with their constituency, each with their interests and requirements and regulations and sense of self-preservation. That makes change harder to accomplish.

Finally, the kind of basic reform in our attitudes toward land use which is required to meet the challenge of development and preservation pressures in our country today necessitates a reexamination of some of our most deep-seated values regarding the private right to property and the public welfare. It is not radical to undertake this reevaluation; indeed it is in the American spirit to constantly question and reform and renew our institutions to make them responsive to changes in public attitudes.

It is interesting to note how these attitudes toward land have evolved in our history as a nation. For the first century after independence, we were a frontier nation with land as the equalizer among our citizens and the promise of those of other nations looking for new opportunities. That land, to be productive and to serve the purpose of equalizer in a democratic society, needed to be made a part of the nation's economy. Transportation was needed to move products to market and to give people a sense of mobility. Communication and education available to all became important services to the growing agricultural nation. Water and power became increasingly important resource needs as the frontier spread west.

In the second one hundred years, the nation's lands were made to bear the burden of two new forces—industrialization and urbanization—as we shifted our role to become a major economic force in the industrialized world. Cheap labor and raw materials were needed to achieve this, and our land had to offer up its resources for production and for expansion. Conservation began and grew, but primarily as a concept of need to protect some resources for future use. In short, our land became a commodity in the market place and subject to the primary economic controls of supply and demand.

As we reach our bicentennial year as a nation, a new sense of ourselves seems to be emerging, manifested in what some have come to call the "post industrial society." This is not to say that economic activity and industrial power will fade or slacken. But the post industrial society will bring some recognizable changes in our way of life. We can see now that more and more employment is opening up in

the service sector of our economy; production of goods is playing a lesser role in current growth. Despite the continued existence of pockets of poverty, there is an unprecedented level of material well-being in our society. Concurrently, leisure time is increasing and it is taking less time on the job for a worker to earn income at a level that allows the purchase of a wide variety of items for the leisure-time enjoyment of the family. More time can be spent in self-education, travel, recreation, and other activities which improve the quality of life.

An unanswered question is how all this relates to the use and enjoyment of our most irreplaceable resource—our land. Will the land be tied to the search for more material well-being and become simply another manifestation of the goods and commodities that this new way of life allows us to surround ourselves with? Or will it be recognized as a finite resource which must be managed and preserved to prevent its consumption and destruction by these new social forces at work? In case there is any doubt, I believe we must follow the latter course. Effective land-use planning and regulation are not only useful to insure a better way of life for us in the post industrial society; they are essential to preserve the land resource from the potential ravages that our new affluence and leisure could bring down upon it if not controlled.

We need not think too long before we find examples of the kind of conflicts I am warning against. Let us consider, for example, the boom in sales of seasonal homes and recreational lands. The unprecedented growth of this industry in recent years has resulted in millions of new housing units for weekend, vacation, or seasonal use. Aside from the economic benefits from this billion dollar industry, we must recognize that it has brought significant benefits to many who never before have experienced natural surroundings to the same degree. Let us also realize that it has resulted in the growth of the conservation movement through broader public awareness and support of environmental issues.

But in many areas, the pace and impact of such land development activities is far beyond the capacity of public authorities to deal with it. *A recent report indicated that enough lots had already been subdivided in Arizona to provide for eight times the population anticipated by the year 2000.* This startling fact, beyond the implications for natural areas from this degree of land development activity, is particularly upsetting because it means that much of the future population of the state is condemned to live in sprawl and unsettled areas under development, not because of erroneous public policy, but because there was no policy at all.

The point I would like to make is that it is possible to provide the quality of life that Americans want and demand without carving up every attractive natural area in the country. A national land-use policy, with assurance of proper authority vested at the state level to oversee development of greater than local significance is a necessary step to bring some rationality into the decisions affecting our land.

Let me give one further example of how we need to accommodate our demand for more leisure activity with our need to protect the resources in our land which can satisfy that demand if properly managed. Behold the cluttered outdoorsman of today, who faces nature through the back door of his camper in a crowded campground filled with noisy machines that he and everyone else have brought with them to make life in the great outdoors little different from life on the patio back home. We see him off through the woods, not on his own two feet or snowshoes or skis, but on a 50-horsepower machine with no muffler and no built-in equipment, optional or otherwise, to respect any living thing.

The point is simply this: There is not enough land in our nation to accommodate everyone who wants a wilderness experience but doesn't want to leave anything behind at home in order to get it. Greater leisure and greater material well-being mean that people will have more money to spend on gadgets and more time to use them. But it also means more access and more choice for people, and allows them to purchase items which expand their experience with the out-of-doors. What we must learn is discretion and good judgment, both in our individual decisions and in our support of public policies to regulate and control activity that destroys the leisure-time experience of others. While we must make provision for the owner of a trail bike, we must also realize that 1000 hikers and 1000 animals can be in the area without disturbing him, but that he alone can disturb all the others by his presence.

When we look at the magnitude of the land-use problem in this nation, there are, amid the complex issues and arguments a number of clear principles which we need to keep in mind. I believe that these principles are recognized and woven into the fabric of the National Land Use Policy Act, which the President has proposed to Congress.

First, we cannot simply go out and acquire in the name of the public all the land that needs protection and regulation. It would be far too expensive, it would be a never-ending process, it would provide unsurmountable land-management problems, and it would run counter to the belief of this nation in the value of private property. I am reminded of a recent article in the Washington papers concerning a group of citizens in the suburbs who banded together to buy 200 acres

of land adjacent to their homes to protect if from development. It cost them $5000 per acre or $1 million in total. As admirable a commitment to open space preservation as this may be, it is not a very practical solution for the vast majority of Americans who see pattern of sprawl over the hillsides and commercial strips along the roadsides. The answer instead is in proper planning and adequate controls on the nature and extent of development.

Let me focus on this matter of controls, because I feel very strongly that it deserves more attention. As you know, we have had planning for years in this country, and the plans are turned out and reviewed and filed. In well over half our states, however, there is absolutely no requirement that land-use controls or development decisions be in conformity with the outlines of the plan. Thus the need for controls and the assurance provided for in the Administration's bill that the state exercise effective control over the important land-use development decisions as well as the planning process is all too apparent.

This brings me to my final point about land-use legislation. It needs sanctions—tough sanctions—or it will never work. Many have argued that if the land-use bill simply contains enough money, the states will do the job. I disagree. In the first place, the major issue confronting the states is not so much financial as it is political, namely the relationship between state and local government over who exercises what powers over land development. Most assuredly, better planning is needed, and this cannot be done cheaply. But it is the premise of the Administration's approach that without sanctions in the national bill, prospects for truly effective state land-use control will be compromised.

These sanctions should be statutorily explicit and not subject to administrative compromise by any review board. In the Administration's bill, States without adequate land-use programs would lose a graduated amount, from 7 percent to up to 21 percent of their highway trust funds, airport construction funds, and land and water conservation funds. If the Congress means business, the bill should say so.

In closing, let me emphasize to you that, while we are working at the national level with the Congress to enact the framework for state land-use authorities, there is nothing to prevent the states from acting now to set up the needed institutions and to begin to work out the important issues of local versus state concern over given classes of land-use decisions. Even assuming federal legislation, the real battle for our landscape is in the state legislatures. It is there, and not in Washington, that the decisions will be made whether in our post-industrial society the land will serve as a resource to support the

quality of our lives or a commodity consumed in a splurge of materialism. I urge you to do your homework, to learn the issues as they affect your homes, your localities, and your states, and to argue forcefully for land-use policies which will assure effective controls and proper planning so the landscape we turn over to our children will be better than the one we inherited.

DISCUSSION

MR. ROBERT CURTIS: It is true that a number of lands in Arizona have been zoned for residential development far in excess of the population.

I was fortunate to be elected by the chairman of the National Resources Committee in the State Senate to serve on a citizen's committee to study the mechanisms of a Senate Land Use Policy Bill. There were fourteen members on this Committee, nine of which were professional-interest people—developers, miners, etc.—and five conservationists or environmentalists. I was one of the five.

The bill that came out of the Citizen's Committee was not to the liking of the minority. I assumed responsibility as a leader of the minority, and went to the Senate Natural Resources Committee with our two versions. The Senate adopted the minority version, which following very closely Senator Jackson's bill and the Administration bill insofar as requirement for a state land-use plan was concerned. Therefore, we have high hopes.

It has now passed the Senate and gone to the House and in my conversation with the chairman of the House Natural Resources Committee, I find it is going to go through the House.

The governor has established land-use planning as a top legislative issue to come out of this session and I feel confident we are going to have it, regardless of the national planning policy which, of course, I hope is going to pass. At any rate, I believe we are going to have a state plan and we are going to control some of this uncontrolled development that Mr. Train alluded to. However, in our ease, we do have a large state, one that is subject to uncontrolled development if it is not controlled and our Legislature this year is going to do something about it.

MR. TRAIN: Of course, there is a lot going on at the state level and I am glad you emphasized the legislation in Arizona. However, some legislation in California was adopted with regard to a development-control law, as well as in the State of Vermont. There is a great deal of activity in this area.

DR. E. J. STAHR (National Audubon Society): Mr. Chairman, many here will agree with you, as I do, that there is no way that the Federal Government or, indeed, public agencies generally, can buy up all of the land that needs proper protection or semi-protection for proper control of its development. However, I do hope that it is still recognized that there may be special cases of very great importance which do justify the direct investment of public funds.

I can think of an example that I would be delighted to have you comment on to such extent you may feel you can do so today, simply to illustrate my point, and that is the Big Cypress Swamp in Florida. Could you tell us something about the prospect for protecting this particular piece of land?

MR. TRAIN: As you know, the President asked the Congress for authority to gain protection over very large areas of the Big Cypress and there was no action in the Congress. I think it is fair to say there was absolutely no indication that there would be any action. However, that proposal is still before the Congress.

I don't know what the prospects are. I don't believe that the Administration reviewed its budget item for this amount.

On the other hand, there was some indication that Congress was going to move, and I am sure I am speaking a little out of turn, in the direction where funding would become available. I don't know that I can throw any more light on it than that.

MR. KEITH OZMORE: Your comments on land-use planning were appreciated.

However, we already have the Coastal Zone Management Act on the books. This is a major step in the protection of this vitally important zone. Yet the Administration has not asked for a single dime in its 1974 budget to implement the Coastal Zone Management Act.

Why cannot we move to protect these zones under the act we have without waiting for the general language of the policy act?

MR. TRAIN: That is a question which I have heard often and, in connection with testimony before the Congressional Committees recently, the Coastal Zone Management Legislation was originally proposed by the Administration back in 1969. The first law was written in my office, in the Department of the Interior. The Administration's thinking evolved beyond the Coastal Zoning Legislation to the development of land-use policy legislation that would cover the entire land area of the United States. When you analyze this, it really makes no sense to try to draw a line of this sort and ignore the rest of the country.

Therefore, over the last two years, we opposed the Coastal Zone Legislation for that reason, not because we were against doing something for the coastal zone but we felt we wanted one national standard authoritiy and that essentially was in the National Land Use Legislation covering the entire United States and which the President had submitted to the Congress.

Of course, the Coastal Zone bill, somewhat modified from our earlier proposal, did pass the Congress last fall. The President did sign it and, you are quite right, there is no money in the budget for its implementation. The Administration has authorized a certain amount of money, which is fairly modest, some two hundred fifty thousand dollars. That simply is to get the planning under way.

I indicated to the committee that considered this that it was our view—the view of the Administration—that funding of the Coastal Zoning Program should be considered together with funding for the National Land Use Policy Act. There is 20 million dollars in the budget for that and I believe it is going to pass.

This involves a difficult matter of timing and I know it is unfortunate. I feel that it is unfortunate that authority does not as yet exist for a program in the coastal area. We believe it should be achieved through the National Land Use Policy Act. That is the reason why separate funding has not been approved thus far.

This is under continuous review and there certainly has been a lot of attention given to this matter. I believe that the Administration should do something about funding the Coastal Zone Bill, and I am sure this is also the sentiment of some of the people in this room.

DR. ROBERT GILES: I would like to ask what you consider the usefulness of the book *Limits to Growth* and similar methodology, to achieve the objectives that you have presented.

MR. TRAIN: Speaking personally, I welcome the *Limits to Growth* study report and I think we all recognize that it has weaknesses of analysis.

Some of the projects, I do not think, really get to the point.

Limits of Growth has had very widespread attention. For example, in the Netherlands alone, some 250 thousand copies were sold last year. Undoubtedly it is having a worldwide impact.

Further, this certainly is implicit to our land-use problem. Modeling, on the other hand, can make a very important contribution. However, sometimes I am a little bit skeptical of models but then I am not a mathematician and I usually find I am way out of my league. I simply do not understand them. However, I do think that models and that kind of analysis can sometimes lead us down dark alleys but, in the overall, I think it is a very useful contribution to a very necessary dialogue.

* * *

THE IMPACT OF POPULATION GROWTH ON RESOURCES AND THE ENVIRONMENT

HUGH DOWNS
Co-Chairman, Citizens' Committee on Population and The American Future, New York City, N. Y.

I want to thank you for the opportunity to present a point of view before you today. As you may know, I have had a long-standing interest in environmental questions. I was fortunate enough to attend the Stockholm conference, and I have been particularly concerned with the issues of resource supply and management. In addition, I have been concerned with population issues, and since July, 1972, have been directly involved with the Citizens' Committee on Population as a national co-chairman. Our task has been to take the findings and recommendations of the Commission on Population Growth and the American Future to the American People. Today, I want to speak to three points that the Commission raised through its research.

First, *even though we have achieved a replacement rate of birth, we cannot become complacent about population growth and its implications for resource management.*

Second, *from the standpoint of resources and the environment, we can "cope with rapid population growth, but "coping" may mean adopting solutions that we don't like or that may be dangerous, including the use of new technologies before we understand the full implications of their environmental impact.*

Third, *population growth is not the problem affecting our environment and resources. It has a multiplier effect along with that of technology and consumption patterns.*

I. POPULATION GROWTH

The Commission found that there are no substantial benefits to be gained from population growth beyond that to which we are committed. In other words, with the lingering effects of the Baby Boom and maintenance of present rates of immigration, there will be a minimum of 50-70 million more people in the United States by the year 2000. This fact shocks many who have confused our present replacement rate of birth with zero population growth. The former refers to the average number of children per family, while the latter refers to the point at which the absolute number of people in the country remains relatively constant.

The birth rate has historically moved downward toward the replacement rate of 2.11 children per family on the average. The one great exception to that trend occurred in the post-World War II years with

the Baby Boom phenomenon. As a result of the rise in fertility during the Boom period of 1947 to 1957, there are an increasing number of females in the prime childbearing ages 20-29. This number will increase from its level of 17 million in 1972 to a high of 26 million women in 1985. As you can see, a slight change in their individual childbearing preferences and behavior could result in an "echo boom." If families maintain the present rate of 2 children per family, population would grow to 271 million people by 2000. If this should change to a three-child family, average population would be 322 million in 2000.

What then are the implications for resource use and management? The Commission found that every area of resource development will be affected by our population growth, no matter what its rate. However, there are three particular areas where population growth will have a significant impact. These are agricultural land, recreational land, and water supply.

Agricultural land.

Under an environmentally sound agricultural policy, limitation on the use of chemical fertilizers and pesticides plus a growing population would force us to utilize all high-quality land by the year 2000. Using the average 3-child family projection, an additional 50 million acres of low-quality land would be required to meet our demands. Because of the heavy expenses of equipment, fertilizer, and manpower required for cultivating this marginal land, food prices would be 40-50 percent higher than the slower rate of growth would require.

Recreational land

If any of you are hikers, campers, or canoers, you know the situation that outdoor recreational land is in. You must now get a permit to hike the Appalachian Trail, to camp in Yosemite National Park, and to canoe the Colorado River. If our population maintains its present replacement rate of birth, there are two primary benefits. 1) There will be fewer people demanding facilities. 2) The population will become older and will tend to use outdoor facilities less than if it were younger. Over the next 30 years the result would be a 30 percent smaller demand for outdoor recreation areas. In any event, demand for recreational opportunities could increase given increased leisure and discretionary income.

Water supply

Until recently water, along with our air and land, has been considered an abundant natural resource. The Commission found that

we will soon have to consider it a scarce resource with the result that increased regulation must be placed on it. Already there is a shortage in the Southwest and this is expected to spread to the North and East. Despite extended use of water treatment, dams and reservoirs, there will be an expected regional shortage of 13.9 billion gallons/day by 1980 and 23.1 billion gallons/day by 2000 under the 2-child projection. Under the three-child projection this would rise even more dramatically.

II. COPING WITH GROWTH

One of the "myths" that sustains the American psyche has been right of free access to nature's abundant supply of water and land, freedom to use our personal property as we desire, and untaxed freedom of movement. This situation has obviously changed and is continuing to change rapidly. Increasingly, we find that the government is forced to exert controls over our lives in the form of admission charges to the great out-of-doors, effluent charges, and increasing taxes on many services and products. In addition, the cost of postponing solutions to social problems in order to deal with the physical demands of increased population is always present.

The desire for new consumer products to make life easier and to alleviate the demand for older products can have potentially damaging effects. A good example is the increased production of synthetic organic chemicals. Production of these chemicals has three environmental effects: 1) the industry has a large power requirement with the resulting increase in the level of air pollutants emitted by power plants; 2) these synthetic chemicals, which are often toxic, are introduced into natural ecosystems incapable of assimilating them, with such results as massive fish kills and plant damage; 3) and, finally, the most serious impact of this industry comes from the intrusion of mercury into surface waters. Mercury, a by-product of chlorine production necessary for this industry, is extremely toxic, and has been found in large quantities in both air and water pollution (Commoner 1972).

We know what some of the consequences of the introduction of mercury into our environment are. In other cases, where the needs for certain products—such as energy—are desperate, we may be forced to utilize technologies whose environmental impact we are unsure of. As one researcher for the Commission said, ". . . our distaste for lung diseases apparently induced by sulfur dioxide inclines us to accept the hazards of radioactive waste disposal, fuel reprocessing, routine low-level emissions of radiation, and an apparently small but finite risk of catastrophic accidents associated with nuclear fission power

plants" (Ehrlich *et al.*, 1972). A slowing of population growth will not solve these problems, but it does give us the opportunity to take more time in making decisions that will affect our future so tremendously.

III. TECHNOLOGY AND CONSUMPTION PATTERNS

Population growth contributes to the difficulty of solving pressing social and environmental problems. It is important, however, to realize the solutions to such problems require a multi-faceted approach that considers the effects of technology and patterns of consumption as well as population. The technological revolution has allowed us to increase our standard of living considerably. It has produced potent fertilizers enabling less land to produce more food, provided high-powered automobiles to transport us around in individual comfort, created synthetic materials that outwear and outperform such former staples as cotton and wool, given us throwaway items ranging from soft-drink bottles and cans to paper dresses, and has improved detergents replacing traditional soaps.

One common factor unites these "breakthroughs" in technology—they all have a greater environmental impact than the technology that they replaced. Another researcher for the Commission noted three different ways that "environmental impacts are generated by human productive activities." These include:

1) Withdrawing from the ecosystem elements whose nutrient values are not returned to the system, with a resulting drain on that system. An example is the exploitation of certain fishing industries through indiscriminate fishing practices.

2) Introducing additional components of the ecosystem to that system from external sources. Examples include the use of synthetic nitrogen fertilizer or the intrusion of sewage into surface water.

3) Adding a foreign substance to the natural ecosystem. Thus, the use of DDT is an example whereby the balance of nature is upset and can produce outbreaks of insect pests. Positively influencing such problems will require thoughtful resource management, responsive economic and political institutions, and an enlightened and concerned populace (Commoner 1972, p. 235).

From another angle we can see that economic growth has a direct bearing on the quality of our environment. Under any set of economic projections, we can expect an increase in the gross national product. It is expected o be at least twice its present size by 2000, and a rapid rate of growth would increase the GNP seven fold by 2020. Such increases in output will exert great pressure on our resources, and produce a noticeable impact on the environment.

Looking at the question from an individual perspective, average family income is expected to rise from its present level of $12,000 per year to $21,000 per year in terms of today's dollars. Given this increase in income (which will tend to be discretionary income), average individual consumption is expected to double. Though much of the increase will come in the service industries, our resources and environment will also be forced to cope with the added strains of increasing affluence.

An ethical question is raised with increasing prosperity. It concerns the 26 million people who are not part of the system that distributes the wealth. This number includes the sick, disabled, unemployed and unemployable, and those female household heads required to stay home to take care of their families. The question is, "Will we distribute our affluence to these people, or will we seize the opportunity to consume more?" When speaking about the quality of life, we cannot forget those whose lives are crushed by poverty.

We also have to ask a question about our use of public dollars. As per capita income increases, will we accept the temptation to lower the tax rate and maintain a constant tax base, or will we take this opportunity to dramatically improve the services that the government can provide?

With these illustrations I would suggest that our societal ills cannot be cured by the slowing of population growth alone. Such growth is only one contributor to the dilemmas we must face today.

CONCLUSION

The decline of our birth rate to a replacement level is giving us an opportunity—an opportunity to meet the problems of resource management and supply head-on; and for the present at least, to escape the frantic attempts to keep up with rapid growth. By using the time that we have we can test out solutions to our resource problems that rapid growth would not have allowed. By no means should that make us complacent, for such considerations as the need for energy and the impacts of technology and consumption patterns on our "quality of life equation" demand immediate and continuing attention.

LITERATURE CITED

Commoner, Barry
1972. The environmental cost of economic growth. U.S. Commission on Population Growth and The American Future. *Population, Resources, and the Environment*, Ronald G. Ridker, Editor. Vol. III of Commission Research. Washington, D.C. Government Printing Office, p. 354.

Ehrlich, Paul R., and John P. Holdren.
1972. Impact of population growth, U.S. Commission on Population Growth and the American Future. *Population, Resources, and the Environment*, Ronald G. Ridker, Editor. Vol. III of Commission Research. Washingtin, D.C. Government Printing Office, p. 376.

PART II
TECHNICAL SESSIONS

TECHNICAL SESSION

Monday Afternoon—March 19

Chairman: RAYMOND F. DASMANN
Senior Ecologist, International Union for the Conservation of Nature and Natural Resources, Morges, Switzerland

Discussion Leader: LEE M. TALBOT
Senior Scientist, Council on Environmental Quality, Washington, D. C.

RARE AND ENDANGERED SPECIES: STATUS AND NEEDS

REMARKS OF THE CHAIRMAN

RAYMOND F. DASMANN

I welcome you to this session; but in a rational and ethical world this session would be entirely unnecessary. However, the fact that we are here is caused by the irrationality of man's treatment of his environment and his failure to comprehend or to feel deep-down emotionally his total dependence on and his interrelationship to the other living creatures of the planet. All of these together form a part of that fragile network on which all life depends, the biosphere.

Today we are considering the fate of endangered species. The extent to which any species is endangered, to that extent humanity is also endangered. This is the reason for the importance of this topic at this session.

We still know very little about life on earth. We are slowly acquiring knowledge but we cannot wait to act until all of the knowledge is on hand. We cannot wait because we are too rapidly destroying the living tissues of the biosphere through actions which are prompted by need, by greed, by fear and by ignorance.

The existence of endangered species serves as a warning by the very fact of their endangerment, wherein they signal to us the need to

maintain, repair and to restore living communities and ecosystems on which our future stability ultimately will depend.

This session is evidence that the bell is tolling, not just for those species which we will discuss here but for all life on earth.

Now, this may sound like a grim warning from a prophet of doom, but those of you who heard Mr. Strong this morning know it is far better to yell "Fire" in a crowded auditorium than to not yell "Fire" and let everyone die in the blaze.

What should we do with the problem of endangered species? The answer lies in part in the causes which we will explore today.

We seek two major causes—the uncontrolled and excessive exploitation of plant and animal life and, secondly, the destruction of habitat of the communities of the world, of which all species form a part.

Now, we have recently seen a step taken to slow down the excessive exploitation through the new Washington Convention on Endangered Species, which will control or eliminate trade in these species. However, this is only one of a long series of treaties and it must first be ratified and then it must be publicly accepted, reach the hearts of people, and then be enforced. Unless it is accepted and enforced it will join the ranks of the previous Washington Convention, London Convention or African Convention, which were all publicized to the same extent but never became meaningful.

The prevention or disruption of habitat and disruption of world biota and the world biotic communities is far more difficult to solve. Basically, however, there is a need for all nations to devote many resources, far more resources than they have devoted, toward a solution. When it comes right down to it, the problem is money and all the things that money means.

I would like to make a modest proposal here towards making funds available to get the job started and I do this without any prejudice against this meeting or any other meeting. However, this proposal would not require money or for us to give up any luxuries and amenities. As a matter of fact, it would not really pinch anybody.

This would involve a proclamation for one year, let's say 1976 because it seems like a good year in this country, as the "Year of the Quiet Earth." We have had a year of quiet sun. In that year there would be no state, regional, national or international meetings of any kind. Everybody would stay home. The money usually spent on travel or for support of these meetings and conferences that are held every year would be donated to the United Nations Environmental Fund and especially earmarked for restoration of the species. As a matter of fact, the hundreds of millions of dollars that would accrue in this year would go a long way toward getting the job off to a fine start.

I am only asking for one year but if the idea takes hold and

becomes a regular practice, every fifth year, perhaps, would be a "Year of the Quiet Earth." The next year everybody would start shouting and screaming again and we would have all these conferences.

I could go a little further and boost this from hundreds of millions to tens of billions of dollars by suggesting that in the year of the "Quiet Earth" we not shoot anybody, start any wars or prepare munitions for war—that we postpone all the killing until the next year and this, I think, would begin to solve all of the financial problems toward restoring the species and habitats throughout the earth.

With these remarks, I would now like to proceed with the formal program and the first order of business is that it is my pleasure to introduce the discussion leader of the session, Dr. Lee Talbot, who has been active in the field of endangered species for almost twenty years. He has carried out a world survey of endangered species, has done many years of research in East Africa on wildlife problems and from that he has gone on to work with the International Biological Program, the Smithsonian Institution, and finally, to launch himself, as he is today, as the Senior Scientist, Council on Environmental Quality, Washington, D.C.

ECOLOGY AND ENDANGERED SPECIES

HARRY A. GOODWIN [1]

International Union for Conservation of Nature and Natural Resources, Morges, Switzerland

We have reached the end of the wilderness and all the wild things have become the wards of man, depending on him for survival. Many species of wildlife are facing extinction. Some are seriously reduced in numbers, or their habitats have been decreased or destroyed, leaving them vulnerable to the threat of extinction. Other species occupy restricted or fragile habitats or are so rare a constant watch must be maintained to guard them from inadvertent harm.

If there is a hope to save many of the world's threatened species, it will be based on somehow satisfying their individual biological requirements within a changed environment. But until disregard for the threatened wildlife of the oceans, savannahs and forests of the world became an international disgrace, biology was concerned mainly with taxonomy, description and enumeration. Biologists had begun to study cover, food habits and animal diseases. They had learned a few

[1] In the absence of the author, this paper was read by Dr. Raymond F. Dasmann.

simple food chains and had begun to examine the complex network of relationships of which a food chain is only a simple segment. This knowledge was gained from "natural history" studies.

Later they learned that food and cover could be manipulated to the advantage of favored species and began to understand that the concept of food web is much more accurate than that of food chain. Not until then did the companion schools of "ecology" and "wildlife management" develop from the related "natural history" studies in an attempt to relate habits and habitats. It became clear that the fundamental system in nature is the ecosystem, which is biology and environment taken together—inseparable as they are in nature.

Ecology was still a "soft" science, not yet matured to where it sought to come to grips with the multiple causes of biological events and structures. But the science and study of environmental biology developed rapidly. Wildlife managers turned from the study of food preferences to an examination of nutrition requirements at various periods of an animal's growth and development—and at various seasons of the year. They became concerned with the effects of cropping on the dynamics of separate populations and experimented with management for a sustainable yield. Much of the new science was gathered empirically; it was tested and proved with a generous amount of common sense. Fish and wildlife management became a science-based technology or applied ecology.

The International Union for Conservation of Nature and Natural Resources was early in applying the concepts of this newly developing science to conservation. IUCN was organized by a group of people who were concerned with pressing conservation problems; and who set specific goals that later were to have a tremendous impact on the consciousness of people throughout the world. Since it was founded, in 1948, IUCN has plotted a course to save threatened species and their habitats. There is little need to repeat here an account so ably presented by Harold J. Coolidge in 1968 at the Thirty-third North American Wildlife and Natural Resources Conference. Though its first efforts were a "fire brigade" action, its long-range program is rooted in ecology. Its work is directed toward the avoidance of extinction of additional forms of fauna and flora, prevention of additional forms from becoming endangered, and preservation of viable wild populations of all species in their native habitats. It has become increasingly convinced that the world's threatened species have a doubtful future unless whole natural areas are preserved where life can flourish in all its complex variety—virgin forests and grasslands; and mountain, wetland, coastal, fresh and salt water habitats.

The requirements for saving endangered species demand more than the content of ecology. Saving an endangered species may involve saving its habitat even before we fully comprehend the functioning of the ecosystem to which it belongs. The bare accumulation of data does not advance the cause of conservation, and there is danger in believing that it will. The white-tailed deer in North America was probably restored and managed as successfully as any species of threatened wildlife, and this was accomplished without first describing the entire forest with all its living and non-living components. Wildlife biologists at that time knew little about energy flow as related to deer and less about mineral cycling. Admittedly many mistakes were made in early conservation efforts. There was an early failure to recognize the role of predators. Often natural communities were managed in a lop-sided fashion, favoring certain species to the detriment of others in the system.

The fundamental idea of a system is that its diverse units function or operate as an integrated whole. So it is with an ecosystem which is the basic unit on which the preservation of an endangered species depends. For more than two decades, IUCN has provided a forum for the development of a conservation philosophy which is based on the concept of an integrated environment. It has engaged in broad-range conservation action programs to preserve unique areas as national parks or as strict nature reserves. These areas contain entire communities of plants and animals, with each unit influencing the survival of the others. The need to preserve a wide range of such natural areas as a long-range goal, while taking immediate emergency actions to halt the destruction of threatened species of plants and animals, and to keep open options for continued diversity in the natural world, is a basic and central idea in the broad IUCN program.

It is a basic responsibility of IUCN to organize the information necessary for the protection of the world's threatened species. This was clearly in the minds of the founders of IUCN, for Art. 1 (2) of the Constitution charges the Union with special responsibility "to the preservation of species threatened with extinction." To accomplish this it has been necessary to survey the status of threatened species and to understand how things got to be as they are and what factors are still at work.

An equally important function has been to organize the known biology of each threatened species so as to determine its conservation needs. A continuing effort is made to obtain comparable and consisttent biological data as well as current information on the status of animals in the wild. Particular attention is given to endangered species whose conservation needs are immediate and urgent and to

vulnerable species which have not fully recovered from past depletion or whose numbers may be declining at such a rate they might subsequently be threatened with extinction.

The information is assembled in the form of short reports under a series of uniform headings and published in the appropriate IUCN Red Data Book. The objective is to draw attention to the dangers facing these species and to provide basic data for action programs which are based on the ecology of the animal populations involved.

In addition it shows at a glance what is and what is not known. Information on some species believed to be threatened is too meager to form a basis for rational action programs. In these cases, more information must be gathered. IUCN serves as the focal point of a comprehensive and practical scientific effort to assess, on a worldwide comparative basis, the status of threatened species and to plan the best way of achieving their conservation. The success of this effort will depend on the full cooperation of qualified scientists and conservation-oriented individuals and organizations.

At IUCN we have just completed a revision of the Red Data Book for mammals. In doing so, we have paid particular attention to available data on present distribution in relation to past distribution; present populations in terms of total numbers and of trends within individual populations; habitat type in terms of condition and trend. We have tried to summarize to the best extent possible the factors causing the situation that has led to the inclusion of that animal in the Red Data Book.

Some generalizations are possible on the basis of this review. Among the reasons why 132 mammals listed in this volume of the Red Data Book are threatened with extinction and an additional 60 are either approaching that situation or have only recently escaped from it, direct reduction by man stands foremost and indirect action which has caused loss or degradation of habitat stands second. For species threatened with extinction, direct reduction is the major cause for 86 kinds of mammals, or about 60 percent of those listed; loss of habitat for 40 kinds of mammals, or about 30 percent; all other causes account for the remaining 10 percent of those listed. The figures vary little for those species included as vulnerable; direct reduction about 60 percent, loss of habitat about 35 percent, and all other causes 5 percent. Animal species which have been over-exploited or persecuted by man, or which depend on undisturbed habitats, whether mature forests, swamps or savannahs, are in difficulty throughout the world. These are broad generalizations, but let us see how they relate to ecology and endangered species.

The natural associations of a plant and animal community are not

a simple collection of separate entities, any one of which can be changed without regard for the others but involve many intricate inter-relations in composition, function, and structure. The two notions that intervene between the concept of an ecosystem and the single animal must be taken into account. Numbers or aggregations of the same animal are known as populations, and the various living populations in a given area are known collectively as a community. Some animals can thrive in a wide variety of conditions and may be represented in a number of communities. Conversely, others are specialized and may be limited to a single community.

Every animal species has a definite geographic range encompassing one or more types of plant communities. Its distribution within this range is influenced by environmental factors. Distribution may be limited by food, cover, competition with a hardier species, or several limiting factors may work together. Each species is dependent on one or more plants, or plants and animals, and on some specific condition of soil and water. Both distribution and abundance of a species are influenced by the condition of an environment which is constantly changing. As man increases and intensifies his use of the land, he continues to change the amount and variety of these plant and animal communities. Over all of the occupied world ecosystems have been altered by man. Few truly natural environments remain, and biotic communities are being constantly modified. All biotic communities are now influenced by man's activities. Understanding the nature and magnitude of these influences—and bringing adverse influences under control—is the conservation goal of environmental ecology.

There are several concepts in ecology that give it uniqueness among biological studies. The concept of environment used in ecology has obvious significance to the technical application of environmental biology. The detection of biological effects of interactions among environmental factors in a given situation is one of the main tasks of ecology. The concept of an integrated living and non-living system and its functional stability or instability is basic to any long-term ecologically-based conservation program. Although a unifying approach has not yet been developed to appraise the long-term influence of the flow and cycling of energy and material in ecosystems, these concepts are receiving a great amount of attention in the field and in the computer programs of theoretical ecology. They need to be integrated into a consistent and workable system for the organization of data for action programs. From the standpoint of the human environment, theoretical ecology may bring about a better understanding of both natural and man-made ecosystems and a strategy for

ecosystem management which will allow for the continued development of human cultures in a balanced environment.

For the species now threatened with extinction, time does not permit the maturation of these concepts. Protection and restoration of species threatened by over-exploitation or reduction campaigns may be a painfully slow process but it is possible if their habitats have survived, if their niche has not become occupied by a hardier species, and if they have survived persecution in sufficient numbers to sustain genetic viability. Assuming there is intent, financial support, and cooperation between political jurisdictions where they are needed, these species can be saved from extinction. Enforcement of protective regulations and application of wildlife management techniques can be effective if they are vigorously applied. There is risk, though, in too much reliance on management, because it involves a certain amount of meddling with systems that we do not understand completely and where there is a great deal of uncertainty.

We may, in spite of our best efforts, suffer the impoverishment of losing a species. Some species may be beyond the help of man. At the turn of the century, in concluding his remarks on the black-footed ferret in *Lives of Game Animals,* Ernest Thompson Seton wrote:

> "When one finds an animal rare in spite of an ample range and abundant food, it commonly means that, for some unknown reason, that creature is dying out; Nature has set on it the mark of the death house. The why-of-it is beyond our present limited knowledge, but some day we shall learn and profit from the truth"

There are many truths to be learned if we probe at length into the ecology of individual species. But we do not have the time. The overall progress that can be made in saving endangered species by concentrating on an individual form is limited.

The central theme of the ecological concept—the idea of the ecosystem—can be applied. Most of the endangered species will survive only if the ecosystems in which they live remain intact or if they can adapt to a changed environment. The concept of an ecosystem is a very broad one, based not on size, nor on the number of interacting parts, but on the functional stability for a given period of time. It is conceived as a dynamic rather than a static situation. Successful conservation programs cannot be based on a preoccupation with saving the animal by itself. Its total environment must be preserved. The complexity of this undertaking can be realized as one considers the fragility of some associations and appreciates the amount of tinkering that has occurred with biotic communities.

Biotic communities are continually lost or changed as conversion of forests, savannahs and wetlands to agriculture, industry and human habitation puts some areas which are essential to wildlife to other uses. Many of the changes thus brought about are irreversible. Virtually everywhere in the world, the rich hydrophytic flora and its associated fauna are being reduced by widespread drainage, filling or inundation. Native forests are being replaced by farmlands or plantations of different tree species; or the large, marketable trees are being selectively cut, removing the highest story of the forest and its associated fauna. Vast areas which were formerly occupied by peoples who lived with nature have become thickly inhabited by agrarian and industrial societies and turned to exploitive uses. Continued and accelerating occupation seems inevitable for some time in the future.

The effect of these events in changing biotic and environmental factors which govern the distribution and quality of major ecosystems is of paramount concern to IUCN. In view of its concern, IUCN agreed to take over the operations of the Section of Conservation of Terrestrial Biological Communities of the International Biological Programme when that activity ended in 1972. Some modifications of the Check Sheet are being studied with a view to adapting the data more closely to IUCN requirements in relation to endangered species and biotic communities. IUCN is developing a system for compilation of data, based on existing classifications of biotic communities. The compilation of information on threatened species will be increasingly organized on the basis of this classification or subsequent refinements of it. In this way we shall be able to combine our joint interests in plant and animal communities by concentrating on the preservation of essential biotic communities.

The broad outlines of plant distribution are not precisely those of animal distribution but form a useful basis for conservation effort. The effect which man has had in changing the ecological boundaries of plant and animal communities makes individual communities sometimes difficult to delineate. Excessive cutting of certain forest tree species or clear-cutting as high up the slopes as possible for conversion to agriculture has caused large-scale altitudinal shifting in many areas. Clearing the lowland forests has frequently left only small patches of the former plant communities—and usually these patches are either not large enough or are so isolated from other like communities that no semblance of the former ecosystem exists. Adaptable species of animals may withstand these changes and form new associations. Others will prove less tolerant and can persist only where or when intact ecosystems are preserved. IUCN's goal is to monitor a worldwide range of natural and man-made ecosystems. It will assess

the extent to which adequate samples of intact systems are preserved, identify additional areas that should be set aside to ensure the safeguarding of a representative series of essential ecosystems, and call attention to the decline or threatened loss of animal species.

To accomplish this, current and consistent data will be obtained on a series of biotic communities. In addition, particular attenion will be paid to endangered species and to vulnerable species whose survival might subsequently be threatened. For other species, the best that can be accomplished is the maintenance of a continuing surveillance of those biotic communities of which they form a part.

For some species, though, particularly those of high economic, scientific or esthetic importance to man, a more critical surveillance is required. Many of this group are mobile animal species which may not be confined to a single biotic community, and others are species subject to exploitation by man in numbers that exceed the potential rates of annual recruitment. In these categories, the vertebrate animals are of particular importance. They require a continuing inventory of their status and of the factors influencing their abundance and distribution.

A standard inventory form has been designed for the compilation of data necessary to appraise the conservation status of a species recommended for inclusion in the IUCN Red Data Book. The format of the Red Data Book has been reorganized to permit the data from the inventory forms to be easily transferred to Red Data Book pages. It is hoped that maintenance of the Red Data Book and critical review of species admitted to its lists will serve to bring resources to bear on the species most needing attention. The resources that are brought to bear must come from a broad base of responsible and qualified organizations, both public and private. No single source of support will be adequate for the chore and a coordinating mechanism is essential to establish priorities of action.

IUCN in collaboration with the World Wildlife Fund has developed a long-range program and a project system with a rating guide for priorities of action. Rather than rely on intuition, hunch or personal interest, objective criteria are used to establish priorities for action. The projects within each major program area are arranged in the order of priority in which they should receive attention. The priorities system is designed primarily to guide the allocation of resources. The priority of need for action for any animal may be expected to change as new or more complete information becomes available. Therefore, priorities are recalculated annually as a function of program review. There is always the possibility that a project which may fit within our priorities one year may not fit the next, due to a

reduced budget, or because more urgent projjects have arisen. In cases where the benefit of an on-going action would be lost by a reduction in allocation, a factor is provided to preserve continuity of action if the situation warrants it.

We found it necessary to adopt some form of priority system. We shall always be seeking to improve this one. It is capable of accommodating change without seriously upsetting the program based on previous priorities. Without being too mechanical, it avoids the faults of loose and imprecise thinking, which often occurs in the absence of a system. A too mechanical approach could lead to some ridiculous inconsistencies (as with the ass of folklore which finding itself at the mid-point between two piles of hay, could not decide which one to go to and so starved). It allows the exercise of judgement and the use of common sense. The system is a basic guide for budget planning and resource allocation.

It will permit more effective planning of project operations and will ensure that priority is given to the most important conservation projects.

The plan involves four separate programs:

1. a basic program established each year in accordance with priorities as indicated by the survey that can be funded from foreseeable income;
2. an emergency program to deal with unforeseen emergencies of highest world priorities;
3. a biotope acquisition program which has already been established on a revolving fund basis;
4. an optional or reserve program to be implemented if additional funds become available after completing the other programs.

A continuing survey of world conservation needs will establish major program areas. These broad areas will provide continuity in program structure and will be revised periodically.

The program areas will be used as a framework of the long-range plan. Within each program area a series of projects will be progressively elaborated. Projects chosen from them each year will make up the basic program and the optional program.

The major thrust will be in the area of conservation of wild species and biotic communities, and this will account for at least 60-70 percent of the program.

The continuing surveillance and review that will result from implementing the plan will guide the establishment of priorities for field research and conservation action. It will provide a uniform basis for the allocation of funds and manpower dedicated to the protection of endangered species and biotic communities. It will enable us to

maintain a constructive conservation program with a goal, a plan and a series of selected actions—and based on the best scientific data available.

IUCN will need the help of the world conservation community to make it effective.

DWINDLING AND ENDANGERED UNGULATES OF CHILE: VICUGNA, LAMA, HIPPOCAMELUS, AND PUDU

STERLING MILLER
U.S. Peace Corps, Santiago, Chile;

JURGEN ROTTMAN
Corporación Nacional Forestal Departmento Patrimonio, Seccion Vida Silvestre, Santiago, Chile; and

RICHARD D. TABER
University of Washington, Seattle, Washington

Chile, though averaging only 111 miles (179-km) in width, is 2,661 miles (4,284-km) in length—with a latitudinal spread (18°-56°S lat) that corresponds to that from Mexico City to southeastern Alaska.

On the north lies the Atacama Desert, one of the driest in the world, flanked by the lofty Andean range with its alpine *altiplano.* Southward the precipitation increases to create a mediterranean zone in central Chile and a temperate rainforest, the Valdivian forest, toward the south. The southern quarter of the country is divided by the Andes, so that while the forest extends southward on the west, there is, on the east, a drier complex of wooded foothills and fingers of the extensive pampas of Argentina.

In the sixteenth century, when Spanish armies invaded this region from their stronghold in Peru, there were five native wild ungulates: three deer, *Hippocamelus bisulcus* and *H. antisensis,* huemul, which look much like mule deer, and *Pudu pudu,* the pudu, which is a tiny forest deer; and two camellids, *Lama guanacoe,* the guanaco, and *Vicugna vicugna,* the vicuna. Of these, pudu, guanaco, and vicuna probably numbered in the hundreds of thousands, while the two huemul species numbered, perhaps, only in the thousands. All have survived.

Over the past three centuries, however, the changes that have taken place on the landscape of Chile have had detrimental effects upon these species. Various accounts show a progressive reduction in ungulate populations in Chile, but provide little quantification or critical appraisal of the causes of the decline. Over the past decade, small groups of Chilean biologists and some international agencies

have increasingly recognized the need for an effective national program of wildlife conservation. However, this judgement has largely failed in arousing the interest of the higher levels of government where funds are allocated, because it is not yet widely recognized that the wildlife resources of Chile—as of any nation—are a potentially significant source of economic and cultural return. Consequently, there has not been adequate governmental support for the development of a body of officers sufficient to enforce existing regulations nor for the accumulation of sufficient biological data on which to base a sound program of conservation.

Chilean conservationists were well aware that this situation, though slowly improving, did not promise to provide an adequate conservation program before a number of species had actually become extinct. This pattern is generally characteristic of Latin American countries, where a shortage of transport has confined University research largely to the laboratory, and governmental agencies are inadequately staffed and funded.

As one response to the need for more field information, the Government of Chile has recently placed several Peace Corps Volunteers in appropriate agencies to assist Chilean biologists. This report stems from one such cooperative effort.

The following species accounts are based on the literature, on the personal knowledge of Chilean biologists, and on two years of field work aimed at filling gaps in the knowledge of Chilean mammals. The present paper represents part of a larger effort which encompasses all of the mammals of Chile, their biology, and their conservation (Miller, Rottmann, and Ewing 1973).

VICUNA (*Vicugna vicugna* MOLINA 1782)

The vicuna weighs some 65 to 140 lbs. (30 to 65 kg) and is found in the high Andean alpine regions. Its original range extended from northern Peru south along the mountains to Atacama Province, Chile and the Department of La Rioja, Argentina. The most favorable habitat within this zone is the contiguous level or rolling *altiplano,* with summer rains, (December-March), but in Chile and Argentina vicuna are also found on more fragmented though still gentle alpine uplands south of the altiplano, which are very dry, with winter rains.

The vicuna was clasified as a rare and endangered species by the IUCN in 1969. In 1970 the IUCN formed a "vicuna survival commission" and in 1971 co-sponsored an International Conference for Vicuna Conservation in Lima, Peru. At this conference a worldwide population of 10-12,000 vicunas was estimated—all that is left of

a population which once numbered several millions and which has lost 400,000 in the last two decades alone (Jungius 1971).

Original populations were located mainly in Peru and Bolivia, where most vicuna are today. The early abundance of vicuna was the result, at least in part, of the husbandry of the Incas, who controlled practically all of the vicuna range, who valued this animal for its wool, and who protected the wild herds for periodic harvest (Koford 1957).

On the best vicuna range the population density under proper stocking (*i.e.* the carrying capacity) is about 64 vicuna per square mile or 21 per square kilometer (Koford 1957). This optimum habitat is ordinarily mixed with drier, less productive range. Over an extensive region of altiplano, good and poor range alike, the carrying capacity is about 5 per square mile or 2 per square km. (Pearson 1951). Much of the Chilean range is less well-watered than the optimum; but original populations in Chile may have been as high as one or two hundred thousand.

Today there are one thousand vicuna in Chile, occurring in many small populations which seem to be genetically isolated. The best vicuna range in Chile is extensively used by the domestic camellids—the alpaca and the llama, and a few domestic sheep. Even though present vicuna stocks occupy possibly suboptimum habitat, we estimate that the carrying capacity of the present available habitat is at least ten times the present stock. It must be understood, however, that the intensive field studies needed for reliable quantification along these lines have not been made in Chile or Argentina and have barely been begun in Peru and Bolivia.

The diet of the vicuna is herbaceous, preferably forbs but mainly grasses (Koford 1957). They water daily (Koford 1957) except possibly after the wet season when vegetation is most succulent (Franklin, pers. comm.).

The habitat use of the vicuna is regulated by their territoriality. Most of the population is divided into breeding units, each made up of one male, 4-5 adult females and 1-3 young. Each unit occupies the same defended territory through the whole year. Surplus males in nonterritorial troops, usually of about 15-25, occupy range outside of established territories (Koford 1957; Franklin 1973).

The female vicuna can potentially breed at one year, has an 11-month gestation period, and produces a single young, or *cria*. In Peru, at the Pampa Galeras National Vicuna Reserve less than 25 percent of yearling females were pregnant, but for two consecutive years over 90 percent of females over two years of age were pregnant (Franklin, pers. comm.). This protected population has increased by

10 percent annually since establishment of the reserve in 1966 (Franklin 1973).

One important reason that vicuna numbers have been so reduced is that their wool is extremely fine, and therefore valuable, which has led to continuous heavy hunting. Enforcement of protective legislation and control of illegal commerce in vicuna skins and products have been hampered by the fact that the vicuna population is spread over four different nations. Until recently it has been an easy matter for poachers to take advantage of laws which might be less restrictive or officials who might be less effective in one country than another, to move vicuna products to market. A treaty for the protection of the vicuna has recently been signed by all of these four nations: Peru, Bolivia, Chile, Argentina. While this is a valuable first step in controlling commerce in vicuna products, protection from poaching is still nonexistent over most vicuna range in Chile, at least, and much needs to be done by way of enforcement.

Looking toward the potentialities of vicuna conservation, we find a favorable economic prospect. A vicuna population produces surplus males at all times. These surplus animals bear valuable wool—many times as valuable as the wool of the domestic sheep or the alpaca. Much potential vicuna range is now unoccupied, although there is a well-distributed remnant breeding stock. Possibly new vicuna range could be developed through water management or other means. So the vicuna of Chile hang on the balance—another 20 years of present trends will probably see their extinction, or, alternatively, another twenty years of effective protection and management could well see their substantial increase and development into an economically important Chilean export. Present developments in Chile which are encouraging for vicuna conservation are:

1. Establishment in 1970 of National Park Lauca (which contains 400 vicuna), and its patrol from 1972 by an official ranger.
2. Approval from IUCN WWF in late 1972 of a request for financial support to provide reliable transportation for the Park Lauca ranger and one assistant.
3. Location and numerical estimation for the main remaining vicuna populations.
4. An increasing flow of biological information is coming from the Pampas Galeras Vicuna Reserve in Peru, supported by the Government of Peru, with help from international agencies.

GUANACO (*Lama guanacoe* MULLER 1776)

The guanaco is a larger animal than the vicuna, weighing 100-290 lbs. (48-130 kg.). It inhabits grasslands and shrublands both warm and

cold, which are sometimes interspersed with forested areas. Its original range extended from northern Peru south to the southern tip of Chile and throughout Argentina—wherever there was sufficient forage. Altitudinally, this range went from sea-level to about 10,000 feet (*4000m*) in Chile, thus covering regions below the vicuna habitat of the altiplano. Much guanaco habitat is quite dry, so they apparently can subsist on dry grasses at least for part of the year. Their need for water is not well understood. Apparently they occupy areas in which free water does not exist; perhaps they lick dew in such cases. They are also capable of using the water of saline lakes and possibly even sea water.

Original numbers of guanaco must have totalled many millions. Like the American bison, they were the dominant grazing ungulate over a tremendous region. The greatest population densities seem to have occupied the pampas of southern Argentina (Patagonia), a cool, dry grassland.

In aboriginal times the guanaco provided the basis for the hunting economy of many Indian groups and was useful for both fur and meat (Gilmore 1950). Because the hide of the guanaco varies in thickness from one part of the body to another, and there is a parallel variation in pelage, hides were typically cut into parts, and parts from many hides sewn into clothing, blankets, etc. The production of guanaco blankets by this means is still common, even in nations such as Chile, where the guanaco is a completely protected species. The pelts of young guanacos, called *chulengos,* are especially prized.

Guanaco meat is acceptable as food everywhere but seems more so in the northern three-quarters of the range. In semi-desert regions the meat is cut in strips and sun-dried; the resulting product, called *charqui,* was recently valued at up to $5.00 per kg., about 3 times the price of beef, in Chile.

Very little is known of the breeding biology of this species. It produces a single young either annually or every second year, after an eleven-month gestation. Perhaps the frequency of breeding, and also the age at first breeding, depend upon the nutritional level of the population, as has been found for some North American ungulates.

Within its Chilean range, the guanaco has been greatly reduced. A recent estimate is that fewer than 13,000 remain in all of Chile, mostly in the southern two provinces. In the southern pampas (Magallanes Province), the guanaco has been persecuted as a competitor of sheep and survives largely near forest cover. No more than about 7000 exist on the Chilean part of Tierra del Fuego, and a low density population of about 3000 is spread throughout the southern pampas of continental Chile. This is contiguous with the larger

guanaco population of Argentina. Guanacos are now absent from the fringes of the Valdivian forest and central valley (Temuco-Santiago) where they were once abundant.

In the north (Santiago-Arica) this species occupied both a coastal strip and the Andean foothills, as well as the drainages of the Loa and Copiapo rivers. The *little north* (through which the Mediterranean Zone becomes increasingly arid and finally merges with the Atacama Desert) was visited by Charles Darwin, who found ". . . desert plains tenanted by large herds of guanaco" (1845:333). In subsequent years this region was heavily used by domestic stock. These, however, suffered seriously from the chronic drought, and recently the Government of Chile closed most of the region to grazing. The result has been some recovery of the vegetation, now being encouraged by range husbandry studies. This increase in potential carrying capacity for the guanaco has not been reflected by guanaco increase, presumably because of relentless shooting pressure, a pressure which has probably increased in recent months as the value of meat has risen. At present only about 1500 guanaco, in small remnant populations, are found in this whole region.

The potential for the conservation of the guanaco as an economic resource seems excellent. As yet, little has been done to realize this potential. Enforcement of legal protection is minimal. However, biological studies have recently been begun on Tierra del Fuego by the principal Chilean agency in charge of wildlife resources, the *Corporacion National Forestal.*

THE HUEMUL (*Hippocamelus antisensis,* D'ORBIGNY, AND *H. bisulcus,* MOLINA 1782)

These deer, much like the deer of North America (*Odocoileus*) in appearance, size, and habitats, are found in two widely differing regions of Chile. The Peruvian huemul (*H. antisensis*) was originally distributed from southern Ecuador or northern Peru southward along the altiplano and adjoining shrubby slopes, possibly as far south as 27°-29° S. lat. in Chile and Argentina. The present distribution of Peruvian huemul extends along this same stretch into extreme northern Chile, but surviving populations occur only as small discontinuous units, located principally in Peru. There is no evidence that the once numerous huemul of Bolivia survive at all.

In Chile, at the southern extremity of its range, the Peruvian huemul probably only numbered a few thousand in aboriginal times. Huemul were not even known to occur in this remote region until 1944. Today one finds a bare remnant of even the small aboriginal population; fewer than two hundred survive. Their habitat consists of

steep shrub-covered mountainsides. Shooting and destruction of cover by charcoal-burners have accounted for most of the population decline, though conversion of stream-bottom habitat to agriculture, and competition from domestic sheep, cattle, and feral burros may have played some part as well.

The Peruvian huemul is threatened everywhere in its range (Grimwood 1968). In Chile, it is unfortunately attracted to irrigated fields and frequently shot as a result.

Hopefully, programs for the conservation of the fauna of the altiplano, notably the vicuna, may provide a measure of protection for the Peruvian huemul as well, since it will bring a greater awareness of wildlife values and a more frequent evidence of enforcement officers to northeastern Chile.

Originally, the Chilean huemul (H. *bisulcus*) was found in Chile and a few adjacent parts of Argentina, from about the latitude of Santiago southward to the Straits of Magellan. In the north they were confined to the Andes, but south of Puerto Montt they spread westward to the coast, and even some coastal islands, and through the foothills east of the Andes. Their habitat in this region is not readily characterized, since today only populations in dense cover survive, but it seems probable that originally this species foraged in subclimax shrubs and adjacent meadows and climax alpine communities.

This species is almost exclusively Chilean in original and present distribution and must have originally numbered many thousands. Today we estimate that only 500-1,500 survive.

Although this huemul appears on the national crest of Chile, and has been fully protected in law since 1929, the decline in population has largely been due to shooting. However, there are several other important factors as well. Burning and lumbering of the forest, in these regions, is quickly followed by intensive livestock grazing. Huemul descending from their subalpine summer habitat in the fall often winter on ranges which have been heavily used by livestock during the summer and perhaps contaminated with livestock diseases as well. They are sometimes caught there by dogs and roped by men on horseback—perhaps a reflection on their poor physical condition—or simply shot.

Huemul occur on some large mountainous islands (the tips of the Andes) such as Wellington and Riesco, but there is as yet no information on their status.

In the northern range of the Chilean huemul there is a potential threat of competition by the much larger red deer (*Cervus elaphus*), which has been introduced in Argentina and parts of Chile. Not only is there a potential for forage competition, but there is strong

evidence from captive animals that the red deer behave in a highly aggressive manner toward the smaller huemul. Knowing how the elk (*Cervus*) of North America dominates the smaller deer (*Odocoileus*), we fear that red deer may readily replace huemul through dominance interactions alone. However, this hypothesis remains to be tested in the field.

If current trends continue, the Chilean huemul will probably become extinct in less than twenty years. Possible remedial measures center on increased protection, especially in national parks, augmented public concern, and possibly control of red deer.

PUDU (*Pudu pudu* MOLINA 1782)

The pudu is a forest deer, weighing only 11 to 22 lbs. (5-10 kg.) It belongs to a genus which is found in several regions of South America, but the species *P. pudu* is currently confined to the temperate Valdivian rainforest, almost all of which is located in Chile. Geographically, its range extended from about 35°S lat. (just south of Santiago) along the Andean foothills and the Coast Range (excluding the central valley), southward to about Concepcion, where it was found in the intervening valleys as well. It is found on southward to about 49°S lat.

This animal is primarily a lowland form and is not found on the Andean slopes at elevations over 5,600 feet (1,700 m) possibly because it cannot tolerate much snow. Its greatest abundance seems to be lower, in thick forest, where it is reported to use the same range year around (Greer 1965). Subclimax areas, if sufficiently well vegetated, are also used. Whether pudu would use open areas if protected is not known.

Pudu range has shrunk markedly as forest has been cleared for agriculture and pastures, and these losses have occurred on the most productive lands. However, more than 5 million hectares of pudu habitat remain, and the present population, despite inclusion in the Red Data Book, must number many thousands. This is not to minimize the downward tendency of pudu populations. Logging and fire, followed by human settlement, livestock grazing, livestock diseases, and hunting continue the pressure against pudu.

DISCUSSION

In 1929 the first all-inclusive legislation provided protection for all of the ungulates mentioned in this report except the Peruvian huemul, which was not then known to occur in Chile. This protective legislation has been virtually impossible to enforce, given the miniscule financial support for this purpose, the difficulty of travel in

much of the country, the general ignorance of the laws, and the relative value of wildlife meat and skins among the poorly educated, susistence-level farmers and hunters, the *campesinos*. In spite of this, we believe that over large parts of Chile, today, shooting of ungulates by *campesinos* is not as important in the continued decline of ungulates as shooting by much better armed, more mobile, and more leisured groups—such as the military on border patrol in remote mountain regions, copper mine employees on their days off, and city dwellers out for illicit sport and profit.

Legal Responsibility

The primary responsibility for wildlife law enforcement is vested in the Ministry of Agriculture. However, there are only thirty-seven enforcement officers for the entire country; thirty-three of these devote their time largely to fisheries, leaving only four to concentrate on the protection of the terrestrial fauna. There are also some 100 honorary game inspectors, but few of these are actually active. Theoretically, the enforcement responsibility is more widespread. Every forest officer is empowered to enforce the wildlife law, and through their basic mandate to enforce all Chilean laws; the same is true of the police—the competent and highly respected *carabineros*.

In rural areas, however, where wildlife populations still exist, and where the shooting goes on, the forest officers and police are often not aware of the wildlife laws, let alone the necessity for obeying them, much less enforcing them. In this situation there is obvious room for programs of in-service training, and this is currently being begun.

Meanwhile active enforcement must be attempted by a tiny force. Nevertheless, there have recently been successful raids on tanneries, in which thousands of dollars worth of skins of protected species—marine and river otters, seals, guanaco, vicuna, pudu, skunk, fox, penguin, etc.—have been siezed. This type of activity, receiving ample publicity, will serve to make the existence of wildlife regulations better known to the public.

Public Information

Another step toward public information was the publication in 1971, by the Ministry of Agriculture, of the *Cartilla Para Cazadores Deportivos* (Booklet for Sport Hunters—Rottman 1971), a popular description of the notable game and protected species and the regulations for their conservation. This has been sent not only to each of the 30,000 or so licensed recreational hunters, but also to numerous officials, including the forest officers and police. This will shortly be followed by a broader and more scientific treatise: *Guia del Campo*

Para Mammiferos Chilenos (Field Guide to Chilean Mammals—Miller, Rottmann and Ewing, 1973, now in preparation). This will constitute a companion volume to *Los Aves de Chile* (The Birds of Chile—Johnson and Goodall 1965) and help acquaint literate Chileans generally with their faunal heritage.

Natural history and wildlife conservation are of keen interest to Chileans, as evidenced by the ready sale of the colorful encyclopedic popular faunal serials—*Encyclopedia Salvat de la Fauna* published in Spain, and *El Mundo de los Animales,* published in Argentina. The television series, *Animal Kingdom,* dubbed in Spanish, is very popular, as are the more occasional National Geographic programs. Within the formal educational system, however, there has as yet been little instruction in natural history or faunal conservation; perhaps partly because of a shortage of teaching materials and a general lack of teacher training in this area. However, a beginning has been made in some professional schools: in 1972, the first course in wildlife biology and conservation was given at the Forestry School of the University of Chile, and the same year the first course on the rodents of Chile (now expanded to the mammals of Chile) was offered in the Faculty of Biology, University of Concepcion. Good curricula in general biology, forestry, veterinary science, agronomy, etc., have long been available, but these have not yet had an appreciable wildlife conservation content. Currently there are plans to add a professor of wildlife science to the faculties of forestry in Santiago and Valdivia and proposals to do the same with regard to the biology faculties of Valparaiso and Concepcion. Hopefully a broader base of education in natural history and faunal conservation will increase the relevance of conservation teaching at all levels and begin to produce the professional wildlife scientists who are now in short supply. At this juncture, a college-level text in wildlife biology and conservation, in Spanish, slanted toward the Latin American scene, would be most useful.

National Parks

It is widely recognized that national parks are important in wildlife conservation, insofar as they contain suitable wildlife habitat. The park officials commonly provide a measure of control over poaching, livestock grazing, timber cutting, etc. which diminish wildlife populations outside park boundaries. In Chile, there are many national parks, often of recent establishment. Not only is the Government of Chile interested in national parks, but the UN Food and Agriculture Organization has been encouraging a systematic approach to park development and planning in Chile.

Chilean national parks administration is handicapped by the inclusion of private lands in parks and more importantly by populations of

subsistence farmers—*colonos*—who settled earlier on public lands now within park boundaries. In general, the settlement of public lands has been encouraged by the Government of Chile, but it is now widely recognized that the continued presence of *colonos* within national parks is not consistent with park objectives. Therefore, the resettlement of *colonos* from present national parks is in progress in some areas and is contemplated in others. And, more importantly for the present, plans are being considered to protect hitherto inaccessible national parks from settlement.

In most Chilean national parks, animals are only one of many values, but two parks have been established primarily for wildlife protection; both are bird nesting colonies in Tierra del Fuego. The new National Park Lauca has been established largely to preserve the scenic beauty of the altiplano, but since it supports several rare species it promises to be valuable for wildlife conservation as well.

For the future, it might be wise to develop a few *Wildlife Conservation Areas,* with specially trained staff and definite programs of protection, maintenance, enhancement, study, and, as necessary, transplantation or cropping. As yet, however, the legislation which would permit this administrative improvement does not exist.

Wildlife Potential

We earlier mentioned that, in Chile, there is a general lack of recognition that wildlife could constitute a significant economic resource. Attempts to promote this recognition now seem worthwhile. Taking the ungulates alone, there is now unutilized habitat, and remnant populations from which to restock it. With simple protection populations could increase manyfold. With the application of present knowledge, they could yield a valuable crop of meat, hides, and wool and contribute importantly to tourism, which yields badly needed foreign exchange. And no doubt these possibilities could be improved through further study.

More than sixty percent of the land area of Chile is nonagricultural, and most of this is at least potentially suitable as wildlife habitat. On grazing lands, present plans call for the development of demonstration areas where, through cooperation with the graziers, an integration of livestock management and wildlife conservation will be begun. In these open regions, control of shooting, alone, should soon show results.

In the forested parts of Chile, the situation is more complicated. The land supports a more evenly distributed human population, the vegetation has been more severely changed from its original condition, there are more conflicting plans for future development, and introduced wildlife is a more important factor.

Virtually all of the current agricultural land and domestic pasture in southern Chile was once forested. This is now unsuitable as habitat for wild ungulates. However, more than five million hectares (2,470,000 acres or 2,855 sq. miles) of forest land remain. Many of these have been temporarily cleared, burned, or grazed by subsistence farmers—the *campesinos*. This has severely reduced habitat for the Chilean pudu and, to a lesser extent, the huemul. The *campesino* presents a severe problem for wildlife conservation because, in his poverty and hunger, he continually attempts to convert potentially productive forest to poor pasture, and to take wild animals for food whenever and however he can. His dogs hunt on their own accord and his livestock compete for forage and constitute a source of disease and parasites for wild mammals. Unless there is a marked change in the rural life of Chile, the *campesino* will continue to characterize the forest zone. Hopefully improved local education and enforcement will help curb his poaching, but only economic betterment will cure its cause.

Exotics.

Parts of the forest region are being replanted, but not with native trees. North American conifers, especially *Pinus radiata,* are favored in new plantations. Such forests in no wise replace the original habitat of Chilean wildlife. If the whole of the Valdivian forest were to be one great productive conifer plantation, much of the characteristic fauna of Chile would probably be extinct.

In addition to exotic trees, there are exotic animals. For a long time Chile has had its European hares (*Lepus europeous*) and English rabbits (*Oryctolagus cuniculus*), mostly around agricultural and grazing lands. More recently, there has been an invasion of red deer (*Cervus elaphus*) and wild boar (*Sus scrofa*) from introduced stocks in Argentina. The apparent conflict between the red deer and the Chilean huemul has been described. What other conflicts there may be remain to be discovered.

The red deer and wild boar, as well as the more restricted mouflon (*Ovis mouflon*) and fallow deer (*Dama dama*) are popularly thought to be good things for Chile since, it is unfortunately assumed, the native fauna is doomed in any event. The whole question of the relations of exotic to native animals and to Chilean forest vegetation needs more study.

International Cooperation

Thus far, we have discussed matters largely internal to Chile. There is an international side as well, though as yet a small one. The international interest in Chile's fauna largely centers on species

preservation. Many of the mammals of Chile, particularly those of the temperate forest, are found almost entirely within Chile; the Chilean huemul and the pudu are ungulate examples. Thus of the five native ungulates of Chile four are of immediate international concern. Even the fifth, the guanaco, is constantly decreasing under current conditions.

There have been several recent instances of international concern for Chilean ungulates. In December, 1971, the International Union for the Conservation of Nature organized a vicuna conservation workshop in Lima, Peru, drawing together workers both from the vicuna range and abroad. This encouraged local workers and helped inform governments. In 1972, IUCN approved an appeal for equipment to be used in biological investigations in Chile, principally by Peace Corps Volunteers and their Chilean counterparts; this proposal was implemented by the World Wildlife Fund. In late 1972, IUCN approved an appeal for a 4-wheel drive vehicle to be used in patrol of the National Park Lauca.

It appears to us that there are a number of additional ways in which international aid could be extended to Chilean ungulates. Specialists in various sorts of field investigation could assist Chilean authorities in obtaining the biological data upon which conservation plans could be based. This joint work could be widely publicized within Chile, and abroad, if support for photographers and media specialists were available. The current demand for wildlife science professors in Chilean universities could be met temporarily from abroad; these instructors could teach, guide the advanced students who would ultimately replace them, and bring together the basic instructional materials for their field.

The need for additional education in wildlife subjects on the part of Chilean forest and police officials can be met to some extent internally. But more rapid progress in wildlife conservation in Chile and adjacent countries might well result from the establishment, with international support, of a regional center for wildlife study and training. This would provide a focal point for the synthesis of information, a facility from which to carry out specific studies and an instructional laboratory for wildlife investigators, administrators and enforcement officers. The whole regional fabric of wildlife conservation would be strengthened as a result.

LITERATURE CITED

Darwin, Charles
1845. Journal of researches into the natural history and geology of the countries visited during the voyage of HMS "Beagle" round the world. London: Ward, Lock & Co. Ltd., 492 pages.

Franklin, William
1973. Vicuna behavioral ecology. Proceedings of the first international symp. of the behavior of ungulates and its relation to management. IUCN, 2 vols. Ed. V. Geist

Gilmore, Raymond M.
1950. Fauna and ethnozoology of South America. Handbook of South American Indians, Bull. 143, 6:264-345.
Greer, J. K.
1965. Mammals of Malleco Province, Chile. Publs. Mich. St. Univ., Mus. Biol. Ser. 3:49-152.
Grimwood, I. R.
1968. Notes on the distribution and status of some Peruvian mammals. Special Pub. No. 21, 1969, Am. Com. for International Wildlife Protection, N.Y. Zoological Society. Bronyx, N.Y. 86 pages.
Jungius, Hartmut
1971. The vicuna in Bolivia: The status of an endangered species and recommendations for its conservation. Sonderdruck aus Z.F. Saugetierkunde Bd. 36.3H., S. 129-146.
Johnson, A. W. and J. D. Goodall
1965. The Birds of Chile and adjacent regions of Argentina, Bolivia and Peru. 2 vols. Buenos Aires.
Koford, Carl B.
1957. The vicuna and the puma. Ecological Monographs, 27(2): 153-219.
Miller, Sterling, J. Rottmann and C. Ewing
Publication planned in 1973 by the Ministerio de Agriculture, Corporacion Nacional Forestal, Dept. Patrimonio, Santiago, Chile.
Osgood, Wilfred H.
1943. The mammals of Chile. Field Museum Nat. Hist., Chicago, Zoo. Ser., 30:1-268.
Pearson, O. P.
1951. Mammals in the Highlands of southern Peru. Bull. Mus. Comp. Zoology, Harvard. 106(3):117-174.
Rottmann, Jurgen
1971. Cartilla para Cazadores Deportivos. No. 4, segunda edicion. Ministerio de Agricultura, Servicio Agricola y Ganadero, Division de Pesca y Caza. 64 pages.

ENDANGERED WILDLIFE ON THE NATIONAL RESOURCE LANDS[1]

BURTON W. SILCOCK AND H. CURT HAMMIT
Bureau of Land Management, Washington, D. C.; and

JOHN E. CRAWFORD
Bureau of Land Management, Denver, Colorado

Forty-seven species of wildlife have become extinct in the United States from 1700 to 1970. The disappearance of 25 species within the past 50 years emphasizes an accelerating loss (Skoog 1972).

Loss of wildlife species is directly attributable to manmade changes in our environment. Urban sprawl, vast expanses of pavement, impoundments, and drainage of our wetlands have exacted a toll upon wildlife habitat in terms of both quantity and quality. Overgrazing, strip mining, and abusive logging methods have placed additional stress on wildlife habitat. Cities and industrial complexes spewing forth air and water pollution have lowered the quality of much of our environment to where it can no longer support any wildlife. These disturbing trends place increasing emphasis upon the importance of the 450 million acres of BLM administered National Resource Lands in helping to perpetuate our wildlife heritage.

[1] In the absence of the authors, this paper was read by John Mattoon.

The environmental movement now sweeping across this land shows the intensifying public concern for our threatened wildlife species. Congress continues to enact legislation reflecting this public concern. The executive branch of government implements this legislation in the form of policy and action programs.

POLICY

President Nixon describes the Endangered Species Conservation Act of 1969 as "the most significant action this nation has ever taken in an international effort to preserve the world's wildlife" (Morton 1970). Secretary of the Interior Morton on August 5, 1971 affirmed the intent of the Endangered Species Conservation Act through direction to all Interior agencies. He assigned leadership and coordination duties to the Bureau of Sports Fisheries and Wildlife and instructed all Interior agencies to plan and carry out deliberate and aggressive programs to benefit endangered species occurring on Interior lands or being affected by Interior programs. All agencies were directed to take whatever action necessary to prevent any native species from becoming endangered and at the earliest possible time to complete surveys of land under their jurisdiction to identify habitat essential to endangered species. Secretary Morton concluded by directing that endangered species welfare will be given prompt and serious consideration in any land or water development project under Interior auspices.

THE NATIONAL RESOURCE LANDS

This policy becomes action when applied to the management and administration of the National Resource Lands. For purpose of orientation these lands are described as extending intermittently from the Mexican border to the Arctic Ocean, from Colorado to the Pacific. The differences in climate and land forms provide an exciting diversity in habitat and wildlife. Contrasts range from the towering heights of Alaska's mountains to the unique Sonoran Desert, from the western prairies to the northern tundra, and from the western mountains to the arctic seas.

The National Resource Lands sustain over three million big game animals, and myriads of small game, sports fish, and nonhunted species (Anon. 1972). Commercial fish production attributable to these lands is equivalent to the total annual fish diet of 12 million Americans. Hunters, anglers, and birdwatchers spend 16 million visitor days each year pursuing their favorite activities on the National Resource Lands.

WILDLIFE HABITAT STATUS

Much of the National Resource Land is found within Alaska where wildlife habitat is in good condition. However, the balance of our Resource Lands occurs mainly within the eleven western states, and here we have a need for improved wildlife habitat. In 1971 we observed unsatisfactory conditions for 44 percent of our big game ranges, 29 percent of the small game habitat, 58 percent of the waterfowl habitat, 38 percent of the lakes and reservoirs, and 46 percent of more than eight thousand miles of stream (Anon. 1972).

These unsatisfactory conditions also reflect the status of our endangered wildlife. Employing "Redbook" criteria, we find that 28 species of wildlife on the National Resource Lands are endangered, 19 are rare, 27 are peripheral, and 15 have undetermined status (Anon. 1968).

Wildlife habitat sustains many conflicting demands and pressures by other resource uses. These demands include recreation uses, livestock grazing, timber harvest, mineral extraction and land transfers to meet expanding urban developmental needs. The pressures and impacts of these uses, as opposed to the needs of wildlife, place our land managers in an extremely complex position.

THE PROGRAM

In directing BLM efforts to help resolve the plight of endangered species, our first effort was toward specific personnel assignments and initiating appropriate coordination procedures on an inter and intra Bureau basis. Staff assignments to our Washington Office Division of Wildlife provide coordination with other Department of Interior agencies at the national level and promote Bureau-wide thrust for our overall efforts. Staff assignments designating responsibilities and coordination needs have been made at all field office levels (Service Centers, State Offices, and District Offices). The Denver Service Center's Wildlife Staff has been assigned data compilation and analysis, coordination and liaison responsibilities for all field offices.

Close coordination is maintained with the Bureau of Sports Fisheries and Wildlife (Interior's endangered species lead agency) at all levels. This provides BLM with helpful expertise and guidance in meeting mutual endangered wildlife goals.

State Governments are responsible for management of resident wildlife in comparison to BLM's responsibility to manage the habitat. We have cooperative programs with many states to benefit endangered wildlife. We also work with universities, conservation organizations, and interested citizens in endangered species habitat preservation and management programs.

Our field programs for endangered species are directed toward inventory and analysis of their habitat. As land managers, we need to know what is there, what are the limiting factors, and the solutions. From this evaluation we can determine actions needed and establish priorities. Our land managers must have these facts to guide them in making land management decisions which fully consider the welfare of the endangered species. Habitat inventory provides the basic foundation for our endangered species habitat management program. Inventory procedures apply fundamental biological concepts and techniques which are relatively uncomplicated in nature. However, our inventory efforts are restricted by a lack of wherewithall to do the job. Field biologists available for this undertaking average one for each nine million acres of the land that we administer.

As endangered species needs are identified through our inventory procedures, habitat management recommendations are formulated. Coupled with other government agency and public participation, management recommendations are fed through a decision-making process that we designate the Management Framework Plan. Through this planning process we make decisions on endangered species habitat needs and other resource pressures as they conflict with endangered wildlife's requirements.

Following inventory and planning efforts, we initiate action programs to meet endangered wildlife needs. In cooperation with the Oregon Game Commission we have helped transplant Alvord trout, an endangered fish occurring only in the Vale District in western Oregon. Water gap fences have been constructed to restrict livestock trampling of the streambank, streamside cover has been planted, and other stream improvements are scheduled.

We sponsored a study of the habitat for the Mexican duck in New Mexico, one of three states in our nation where the species occurs. Study results are now being applied to the restoration of the San Simon Cienega in New Mexico, historic marsh habitat for this duck. Restoration is being accomplished through the development of wells, pipelines, potholes, dikes, and fencing to keep livestock from removing nesting cover. Our objective is to maintain this species within the United States through increasing the numbers to a stabilized breeding population on the Cienega.

The Snake River Birds of Prey Natural Area was established in Idaho to aid in the survival of the golden eagle, peregrine falcon, and prairie falcon. This 26,000-acre sanctuary is a unique blend of desert, river and cliff complexes. We are now participating in a study on raptors in this area for the purpose of improving our habitat management.

With the Nevada Department of Fish and Game, we are working to preserve a newly discovered sub-species of Bonneville or Utah cutthroat trout previously believed to be extinct (Cain 1971). This population has increased over 3000 percent in the last ten years. The Nevada Department of Fish and Game prohibited fishing in effort to restore the Bonneville to reasonable numbers. Another joint project has blocked a stream to fish migration through construction of a barrier to protect the genetic strain and eliminate competition from other fish.

BLM has developed ponds, wells, springs, and erected protective fencing within Nevada which have successfully increased the endangered Warm Springs pupfish in one spring from an estimated 50 to over 400 within three years (Myers 1971).

Survivors of the Ice Age, the desert pupfish of the Death Valley system are found only in a few areas in Nevada and California. BLM is one of several federal agencies cooperating with the Fish and Wildlife Service in continuing efforts to save the pupfish from extinction. In California BLM has successfully improved habitat for the Owens River pupfish at BLM springs and in Nevada has cooperated in transplanting the Devils Hole pupfish to springs on National Resource Lands.

In Montana the Westslope cutthroat trout has been protected through fencing to eliminate livestock trampling and through stream improvement on Wales Creek. Tule elk have been protected through development of a comprehensive habitat management plan in cooperation with California Department of Fish and Game, municipal agencies, Bureau of Sport Fisheries and Wildlife, National Park Service, and U.S. Forest Service. This plan provides for the perpetuation of their habitat.

Habitat management plans have been developed in California, Idaho, Montana, Nevada, New Mexico, Oregon, and Utah for 17 species, of rare, endangered, or peripheral wildlife. They have been developed cooperatively with appropriate state and federal agencies, conservation organizations, and universities. These plans identify the habitat area for the species and set forth an action sequence for habitat management and improvement.

To add to our field expertise we are developing a habitat oriented literature compilation through contract with the Denver Conservation Library. These efforts are directed toward endangered and other unique wildlife species occurring on the National Resource Lands. The objective is to provide our field personnel with the most up-to-date information and a goal for improved understanding of the interrelationships between the species and its environment. Reports

completed to date include the American and Arctic peregrine falcon, blackfooted ferret, blunt-nosed leopard lizard, spotted bat, kit fox, and bald eagle. A limited supply of copies are available for other Government agencies, universities, conservation organizations, and interested citizens.

CONCLUSION

Intensified public concern for our environment and wildlife have created a demand for all levels of government to engage in active and positive programs to stem the tides of wildlife extinction. We have embarked on an ambitious program to benefit endangered wildlife. Many of our avenues to success are clouded by complex, competitive demands on endangered wildlife habitat by other resource uses, and the nation's need for energy. Unraveling ecological complexities to isolate and solve habitat related problems is not a simple task. Funding and manpower are not available to meet all needs. Despite these difficulties and constraints we are devoting our best efforts and energy in trying to insure that no additional wildlife species become either endangered or extinct on the National Resource Lands.

LITERATURE CITED

Anonymous.
1968. Rare and endangered fish and wildlife of the United States. Committee on Rare and Endangered Wildlife Species, BSF&W, U.S. Dept. Interior, Resource Pub. No. 35, Wash., D.C.

———.
1972. Wildlife statistical report. Unpublished report. U.S. Dept. Interior, BLM, Wash., D.C.

Cain, D. & F. H. Dodge.
1971. Research and management on an unidentified cutthroat trout in eastern Nevada. California-Nevada Wildlife trans. 6:32-37.

Morton, Rogers C. B.
1971. Endangered fish and wildlife conservation. Memorandum to Interior Secretaries and Agency Heads, U.S.D.I. August 5, 1971.

Myers, L.
1971. Pupfish habitat management, Cal-Neva Wildlife Trans. 6:38-42.

Skoog, Ronald O.
1972. Personal communication. BSF&W., Office of Endangered Species and International Activities. Nov. 11, 1972.

DISCUSSION

DISCUSSION LEADER TALBOT: Thank you very much for that interesting presentation.

MR. ERIC BOWEN: I am curious about the habitat work. What has been the response, for example, of the Mexican duck with regard to this habitat work?

MR. MATOON: We have with us Mr. Crawford, who is a wildlife specialist. I would like to have him handle that please.

MR. JOHN E. CRAWFORD: The follow-up on the various programs is a continuing process which is provided for under the evaluation segment of our wildlife managing systems. With regard to the Mexican duck program, it is still very much, in the biologists' judgment, successful. During the past winter we counted more than 26 Mexican ducks, a drastic improvement from a zero base in 1966.

We have completed most of the improvements and developments on approximately a third of the area. Probably during the next two years, evaluating the response

of the birds to our habitat efforts will tell us whether we have met our goals effectively. All I can say right now is that we are still trying.

MR. WALTER B. SMALLEY: I was very much taken with this paper and I am also concerned with the present situation of the American Indian. As a matter of fact, if we got in touch with some of the more intelligent young American Indians and put them to work, they might be able to help us because they have a native instinct for this sort of thing. I think we should turn things around and begin to use them for creative purposes. This could be done if you approached them in the right manner.

MR. MATOON: Certainly, sir, you have a very excellent point.

We have within the Bureau, a rather energetic program for the employment of natives, Indians native to Alaska and the Southwest in particular. We have a program for them, if they do not have a technical education, for training them as technicians. We don't have any specialized training program in the field of wildlife but we attempt to recruit and use Indians and natives whenever we can and we have, we feel, been utilizing their skills.

MR. ROLAND CLEMENT (National Audobon Society): I have a comment and a question.

I first want to congratulate the BLM on some recent and very forward looking steps that it has taken, initially, for example, in creating the Snake River protection area, which is a demonstration of the opportunity we have for providing protection where it is really going to make a difference and, secondly, for providing a series of useful technical reports on distribution and needs of particular rare or endangered species on the public lands. This is a real contribution and we congratulate you and hope you can keep it up.

Many of us who have not been able to keep track of all the implications of new legislation are wondering whether the new Organic Act, which is in the making right now, will, in your opinion, provide the necessary statutory leeway to provide the American public with a truly balanced land use plan. Could you comment on this briefly?

MR. MATOON: First of all, thank you for your comments in relation to the protection of certain species—we appreciate that very much.

By all means, yes, I could not say it any more strongly. If the Congress passes the National Resources Management Act, otherwise known as the Organic Act, it could not do anything but help our wildlife program. I am sure that the mandates from Congress will be similar to those for the National Forest System, Fish and Wildlife Service and the National Park System. Certainly, whatever the will of the people that wildlife values be recognized, we feel it a key to the more effective management of national resources land for wildlife purposes.

DR. TALBOT: John, in your presentation, you mentioned the very effective inter-agency cooperation with the Bureau of Sport Fisheries and Wildlife on endangered species. Although we do not have a formal paper, I think it might be of interest to the audience if a representative of the Office of Endangered Species could briefly outline the endangered species program of the Bureau and the recovery plan concept.

MR. EUGENE RUHR: I might explain how we originally developed the various programs with other federal and state agencies to do this tremendous task because I don't believe that any one agency can do it alone.

We have under way the development of recovery plans for each of the endangered species. These recovery plans are an effort to identify the problem in the restoration of each species and, in a step-by-step fashion, find the solution to these problems.

By "we," I mean all of us, so that we can make assignments to the various agencies, both inside and outside of government. Then, by using priorities, we will concentrate these diverse efforts for the greatest betterment to the individual species. For example, we can see where some effort to restore the white-footed bear would fall under the jurisdiction of a number of federal agencies, including the BLM.

We can identify in this plan the various steps that each agency is going to perform so that, together, it would have the greatest chance in resulting in restoration of that particular species.

We are just starting to prepare these recovery plans. We have a number that are nearing the point where they will be operational.

We consider these plans to be never really completed, not a document that you file but one that you put on the wall so you can see what progress is being made.

Each plan will be initiated by one individual who is most knowledgeable on the species and then it will get severe review in order to bring in the thoughts of all of agencies and individuals who will have a role in its implementation. After that, it will be more widely available for broader criticism so we can come up with a plan that will offer the best intentions of all the agencies involved as well as having the support of the public.

CONVENTIONAL AND UNCONVENTIONAL APPROACHES TO WILDLIFE EXPLOITATION

ROBERT K. DAVIS AND STEVE H. HANKE[1]
The Johns Hopkins University, Baltimore, Maryland

FRANK MITCHELL
York University, Nairobi, Kenya

Present wildlife conservation concerns are of worldwide origin. The scope of concern has been extended from that of game animals to those of ecological and esthetic interests. Although we try to keep this worldwide perspective in this paper, we also believe that Africa, and in particular East Africa, where the authors have some first-hand knowledge, provides modern day conservationists with the clearest and most pressing test of their ideas and programs. Therefore, most of what we have to say will be focussed on East Africa.

It will also be evident that we are not concerned solely with the problem of species extinction, or endangerment, which we consider to be a sub-problem in wildlife management. Our limited concern with endangerment leads to an agenda for wildlife management that seems to be unconventional, if we take as a measure of conventionality the amount of financial, moral and verbal support which an approach engenders.

In brief, our categorization of conventional wildlife management is that it is concerned with protection. The unconventional approach, which we wish to discuss, emphasizes use. We find no fault with protection as such, but only with its misapplication where development of use could be more effective. Nor do we find that all is perfect with the approach which develops uses of wildlife, only that it may succeed where protection is bound to fail.

[1] The authors are indebted to the National Audubon Society, the World Wildlife Fund and Welder Wildlife Foundation for financial assistance and to Carole Grossman and Roland Clement for help with an earlier draft. The opinions expressed, of course, are their own.

In the first part of this paper we will discuss the reasons why we think it is imperative that the world conservation movement rethink the thrust of its efforts, particularly as they impinge on East Africa. In the second part we lay out what seems to us to be basic concepts for a revision of wildlife policy.

CONVENTIONAL WILDLIFE MANAGEMENT

If extinction of a species is of concern, then it may be helpful to catalog the reasons for this concern. In our prehistory, it is not likely that our hunter-gatherer forebears had any general concern for endangerment and extinction. They were not even aware of it. Recent anthropological evidence portrays a hunting society as one of plenty where there is little basis for concern for the future (Lee and Devore 1968).

For most of recorded history the principal problem of wildlife management has been the reduction or elimination, by commoners, of animals hunted by the king and the aristocracy. Only those animals affording sport to the upper classes were of concern. Elimination of vermin (useless or harmful species) could be greeted with indifference and even applause (Graham 1973). Commercial expolitation of wildlife has also given man an interest in some species.

More recently, wildlife has taken on a more general significance to society, one which extends beyond its sport or commercial values. We now believe that all wildlife has some value as part of particular ecosystems and we are willing to pay something to preserve substantial portions of natural ecosystems for their intrinsic values. The values may be recreational, scientific, or our motivations may be to bequeath certain complements of wildlife to our heirs (Krutilla 1967).

The threats to wildlife which lead to endangerment and extinction can come from direct exploitation or from competition with more valuable activities. Exploitation can directly endanger a species by reducing populations. Protection through regulation or abolition of exploitation and/or the setting aside of reserves which are protected are logical remedies to exploitation. Threats to a species which come from competing uses of its habitat are a different matter. Such threats can come from agriculture, forestry, intensive use of rangeland, urbanization, drainage, roads and other habitat changes. Protection and reserves are often insufficient responses to this type of threat, the former for obvious reasons and the latter for reasons we shall examine shortly. A failure to clarify the nature of the threat to wildlife can only lead to muddled attempts at management.

Most of us have inherited a British outlook on the problem. Certainly the two-thirds of Africa which has come under British rule

at one time or another shows a distinctive game law system which varies little from the hunting rules at home. The chief features of the system are charges for hunting licenses and penalties for unlicensed hunting, violations of closed seasons and the killing of protected species (Hayden 1942).

The extension of this system to international controls on trade and attempts to eliminate demand for certain wildlife products (such as leopard skin coats) would seem to imply that endangerment from exploitation is the chief problem facing the world's wildlife. This may well be true for the marine mammals. There is as yet little or no competition for the habitats of whales and seals. But there is active competition for the leopard's and ocelot's habitats. The poacher in the East African bush or the jungles of the Amazon is generally portrayed as killing off for personal profit animals which are otherwise destined to live natural lives. In reality, the poacher may be taking an animal which is already in some degree of conflict with other activities (usually agricultural) and is destined to die of deprivation or at the hands of the game department control officer.[2]

It is, therefore, imperative that we distinguish those cases where overexploitation is taking a species to the brink of extinction from those where competition for habitat is the cause of decline. There are of course cases in which mixed effects are present, such as when habitat destruction makes a species more vulnerable to exploitation. When an animal reaches the low status of the California condor or the whooping crane, it is essential to protect both its habitat and its population.

The creation of reserves and parks for the protection of an over-exploited species in its natural ecosystem is not sufficient if there are also competitive factors at work. An example from East Africa illustrates this point. The parks in Kenya, Tanzania, Uganda, and Zambia now cover 38,000 square miles. Although these parks are impressive in size, individual parks and reserves are rarely self-contained ecosystems; they are rarely coterminous with the animals' natural range including migration routes. Often, a sufficient supply of food and water is available in reserved areas during one season only (Myers 1972).

In such a case the fact of poaching is a superficial artifact to the important factors of competition for habitat.[3]

The flaw in relying on parks to conserve wildlife becomes more

[2] Under the circumstances of an irreversibly dwindling population, the only real way to optimize returns to the resource is to harvest it, thereby converting a disappearing natural stock to a valuable form of capital.

[3] Myers' preliminary findings on the leopard and cheetah in East Africa seem to support this viewpoint particularly for the latter (World Wildlife Fund 1972).

evident as the pressures for economic development are felt on lands abutting the parks and reserves. Since all parks are so structured that many of their animals must spend some time on adjoining lands, the forage and water they consume and the livestock which falls victim to them through predation or disease become increasing irritants to the adjoining landowners. If these landowners receive no gain from the existence of the wildlife to offset the costs which these animals impose, then the landowners have no incentive to countenance either the parks or their wildlife.

Under these conditions, parks become self-contained zoos. The protectionist strategy becomes self-defeating because the more effective protection is the more it robs adjacent landowners of any interest in the wildlife and forces the park to operate as an artificial enclave.

A look at attempts to restrict and control trade in wildlife within a country such as Kenya, Tanzania, or Uganda, where there are still large populations of herbivores and carnivores capable of sustaining harvest, suggests a system which may be doing more harm than good. The management systems of these countries are predicated on the restriction of trade, on the principle that the less trade there is the better off all wildlife will be. This has resulted in a system of paper permits which are voluminous, complicated and virtually guarantee that trade will go underground.

The result is that everyone loses except, perhaps, those who are willing to risk the penalties of illegal trade. The government loses a potential source of revenue and a source of statistics on actual commerce in ivory, rhino horn, leopard and the like.[4] A legitimate industry loses to the black market. The original producer loses by having to take lower prices from a depressed industry dominated by monopolist buyers and low quality skins. In the end it is wildlife which loses by having its attractiveness lowered relative to other uses of the land.

A critical question is whether the alleged benefits of wildlife preservation can be achieved at a lower cost to society than by reducing the legitimate trade in skins and game products and thereby encouraging the illegitimate trade. Studies of underworld activities in other areas of trade allow some specific speculation about the costs to society of forcing skins and game products into a black market. Firstly, the black market gives the criminal, whether a native poacher in the field or a dealer in skins in the city, the same kind of protection

[4] This information is vital in assessing trends in stocks of game and rates of exploitation. For example, it is likely that ivory, rhino and leopard exports from East Africa have increased over time but statistical proof exists only for ivory, which is recorded by Customs instead of the Game Department.

that a tariff gives a domestic monopoly. It guarantees the absence of competition from people who do not want to be criminals, giving an advantage to those with a skill for evading the law. Secondly, members of the police force are made vulnerable to bribery and become potential accomplices in further limiting competition.[5] If a new competitor enters the black market, the criminal can inform the policing agency to have the potential competitor prosecuted under the law. Thirdly, a large number of producers and consumers, not ordinarily criminals, are taught contempt for the law by being obliged to trade with criminals. Large black markets may generate enough profit to enable criminals to engage in other illegal activities. Without these key black markets, crime in other areas might be substantially reduced (Schelling 1967).

In this brief review we have been unable to cite the many positive accomplishments in East Africa and elsewhere of the "preservation where possible" policy toward wild animals. What has been emphasized is the distinct possibility that reality is changing so rapidly that conventional policies are becoming increasingly inappropriate. The situation calls for a review of policy, and, we think, a reformulation.

A REFORMULATION OF WILDLIFE POLICY

The following discussion is again based on current events in East Africa. It is here that we believe that wildlife conservationists have the best opportunity to break out of traditional molds and it is here that new events are forming.

The present concern for the conservation of wildlife in Africa is still focused on restrictions of trade in endangered species and the hunting privileges or esthetic interests of affluent people from Western countries. Although some African officials support this emphasis, others question it, and the politics of conservation becomes complex. European countries no longer have direct control over the wildlife policies, although European as well as American money does influence decisions. Those who would continue established conservation policies have run into a barrier, namely, the African nations themselves. The African governments recognize the economic value of the American and European interests in wildlife. But they have begun to consider wildlife conservation within the context of the political, social and economic needs of Africans. Preservationist policies are competing not only with those to whom hunting is still a

[5] It should be noted that the game departments of East Africa under both colonial and national rule have been noteworthy for an absence of documented corruption. Although the rumor mills have for years spread incriminating tales, few of these have been turned into actual convictions.

necessity, but also with those people who would claim for other uses the land on which wildlife exists.

If the West is to contribute to conservation policy, we will need to approach the problem innovatively, that is, with clear understanding of its causes and with the needs of the African people in mind.

Species extinction is not the major problem in Africa. Rather, the threat is the possible diminution of the large free-ranging herds that have roamed the African savannah since the Pleistocene. A few years ago a poignant book entitled *End of the Game* (Beard 1965) lamented the passing of the animal communities that survived with low density human occupancy. However, human occupancy of game range is increasing as African populations boom. New and more intensive uses are found for much of the land as pressures for economic improvement are felt. So the end of the game is in sight and it will come about through the process of economic development unless new uses are found for the game.

Some governments are responding to the new situation by attempting, with international assistance, to establish programs for using free ranging herds for economic returns. Zambia has an elephant cropping project in the Luangwa Valley (Steel 1968) and Kenya is studying herbivore cropping in Masailand (Swank 1972). The future of wildlife in Africa is closely linked with the success of these projects in identifying ways in which wildlife will pay its way on private lands and with the extent to which it proves possible to put those methods into practice. Our purpose here is to provide an economic and institutional background to these efforts.

We begin with the premise that the goal of a nation with considerable wildlife resources should be optimal land management rather than than maximization of wildlife populations or even maximization of returns from wildlife. Wildlife is but one part of the land system and only one of the outputs to be optimized.

Production economics stipulates that returns to all productive activities must be optimized simultaneously. It is no more correct to maximize the value of the wildlife output and ignore other components of the land system than it is to maximize the value of timber production and ignore the other components of the forest system. Developing the land system for optimal contribution to the economy is also more consistent with the plans which African nations have for themselves than is the imposition of narrowly conceived wildlife conservation programs. Kenya's development plan, for example, emphasizes that accelerated development of rural areas will be a key strategy (Republic of Kenya 1969).

Planning for optimal resource management requires information on

costs and returns. A policy of strict wildlife preservation precludes the development of market information and the consequent incentives which would induce landowners to consider the management of wildlife on their lands. Only if wildlife were established as an economic resource to be exchanged in legitimate trade would information be available to aid landowners in determining what to produce and how to produce it. By transmitting this information through prices paid by consumers to producers the markets can guide resources from lower to higher valued uses.

Making wildlife an activity in the production system creates a need for information about production functions. Interspecies competition, rates of conversion by different herbivores, and tolerance levels for predation and disease hazards, must be studied. The great bulk of wildlife research in Africa has not been oriented toward the collection of these data and has produced little useful information for production management.

The production economist would then use such data in addition to information derived from prices to determine optimum land uses. Knowledge of the productivity of different herbivores on different grassland systems, the degree of competition between species and the net return from different species would permit the planner to determine the best economic combination of wildlife and domestic stock for any rangeland setting.

The source of prices deserves some attention. For the reasons detailed in the discussion of the game skin industry, very poor information exists on the skins and meat value of East African game. Values from tourism are better known, and frequently are greater than any alternate form of returns to the land (Mitchell 1968). Developing better functioning markets for wildlife products is necessary to serve the dual needs of better information and higher returns. The contrast between this need and the thrust of traditional wildlife policy is obvious.

The major problem in the management of wildlife is its fugitive nature. Wild animals are not commonly bound to property lines. A population may range over a number of private ranches. Wildlife is a common property resource in the eyes of the individual ranchers. Consequently, each individual rancher feels free to maximize his take from the herd, ignoring the external costs he is creating for his neighbors. The only protection one has in such a situation is to capture the resource at the fastest possible rate. It is obviously necessary to create institutions which make individuals conscious of the external costs associated with the exploitation of fugitive resources (Wantrup 1952). Traditionally this has been tried through game laws and penalties for violators.

A preferable means of coping with this problem would be to create a superfirm encompassing a number of ranches. The boundaries of this consortium should be defined by the range of a free roaming herd of herbivores. The super-firm might consist of ranchers in the area, of an independent firm, or of government agencies in various combinations. The firm would act as concessionaire for the ranchers, managing the wildlife enterprise and returning rents to the landowners in exchange for the forage and water consumed by the herd of wildlife on each ranch. These payments would, in effect, be grazing fees to compensate for the reduction of grazing livestock which the same space could otherwise support. The returns to livestock on some Masai ranches in Kenya indicate that the size of the payments needed to make wildlife attractive in comparison with cattle is indeed quite low[6] (UNDP/FAO Mission 1970). It is quite likely that such a firm would be more efficient than individual ranch managers attempting game management on their own lands. Not only would the problems of common property be reduced, but the proposed firm would be able to take advantage of techniques of management which involve a scale too large for the individual ranch. Game cropping techniques being developed in Africa (in addition to sport hunting and game viewing) involve a scale of operation best suited to a concessionaire with a territory large enough to encompass a number of normal Masai ranches, as these are currently being developed. There would be advantages in promotion and marketing of products.

The mix of enterprises in which the concessionaire could engage would depend upon production and marketing opportunities. Hunting, cropping, game viewing, including tourist lodges are all possible parts of the mix. It is important that the concessionaire be free to bargain with the ranchers over management and in return that the ranchers agree to keep the wildlife free from harm. If the ranchers receive sufficient income from the game, they should become an effective police force in protecting it from interlopers.

The concessionaire cannot, of course, have an entirely free hand since uncertainties could very well dictate a shortsighted philosophy.[7] The concessionaire would be required to keep a running account of reproductive information and age structures from the animals harvested. Government biologists would monitor population numbers and set quotas for harvest. Such quotas would become the heart of the

[6] Indeed, reports from Rhodesia, New Zealand (Crawford 1972) and Texas (Ramsey 1965) provide abundant examples of wildlife returns competing successfully with returns from livestock.

[7] It may be possible to overcome some of the uncertainties and at the same time increase the returns to the wildlife by employing longer term, formal leasing agreements with the concessionaire (Wantrup 1952).

economic policy toward wildlife. In the past, rates of offtake have been conservative (UNDP/FAO Mission 1970). Perhaps this was justified by lack of relevant information and the absence of pressure on the land. As production information is collected, it should be possible to set offtakes to achieve any population goals desired. But we do not wish to suggest that sustained yield management is an all-pervasive goal. In some cases, it may be desirable to let stocks run down; in others, to increase them. The policy may be cyclical following drought patterns or it may follow a trend dictated by the nature of the optimum land use.

If overregulation were eliminated, a private market for meat and skins could be expected to develop. Health inspection would become the most important regulation in the meat market. It is likely that steady supplies of good quality game meat would competitively reduce the markets for illegal meat. The regulation of the skins market would consist of a marking system which, according to crime technologists, is readily available and impossible to duplicate. Marking legitimate skins would make it possible to detect illegitimate whole skins. Since the skin remains in one piece until the last stages of processing, it would be feasible to maintain surveillance of the raw skins and tanning process to intercept illegal skins.

In discussing the restrictive regulation of the game skins trade in East Africa we have implicitly assumed that the industry would come into the open under a more encouraging system of governmental regulation and would gradually behave so as to benefit wildlife conservation. Such behavior would incdule development of markets, competitive purchase of raw skins from the producers, upgarding quality of processing and manufacturing, and cooperation with government programs to regulate offtakes by species and area. It must be recognized that the anticipated performance of the industry in a reformulated game policy is still a black box.

What we know in a systematic way of the fur industry comes from one U.S. study (Fuchs 1957). If the East African industry performed as the American industry has, there are no miracles to be hoped for. The American industry is unstable, secretive, and shows little imagination either in coping with the competition of other industries or in meeting its conservation problems. The one bright spot in the American industry is the company which, in partnership with the government, monopolizes the fur seal trade.

This experience suggests an approach for developing an East African wildlife industry. The government might consider giving this industry the protection of a series of area-based monopolies in return for which the industry could be expected to show some of the imagina-

tion and drive that come from stability.[8] Such a partnership could also be expected to make it easier to bring the industry into conservation programs. Some such complete reversal of present restrictive policies will probably be necessary if the industry is to be reformed.

COMMENTS ON FEASIBILITY

We argue for a market-oriented approach, but not to the exclusion of parks and protection. Policing and control activities directed toward preservation of wildlife would cease to be the main content of game policy in Africa. A market-oriented approach reduces some of the traditional problems of control. Allocating limited property rights in game to ranchers and concessionaires gives individuals incentives to control illegal entry and cheating. Making game the property of the state, on the other hand, invites individual cheating against the public at large.

The ease of administering a reformulated policy is encouraging. Certainly, setting up self-policing markets reduces government's administrative burden and permits it to concentrate on monitoring populations and harvest quotas.

The social or cultural feasibility of a market-oriented approach to wildlife conservation must also be assessed. Most of the wildlife resources of Kenya and Tanzania exist in the pastoral areas. The pastoral areas in Kenya are being adjudicated into group and individual ranches held on a freehold for the first time, giving pastoralists the legal basis for intensive management of the land. Pastoralists are now receiving large-scale technical and financial assistance from Kenyan and overseas sources to permit and induce them to improve their management practices, specifically to raise substantially their domesticated stock production. Even though most of the Masai are subsistence pastoralists today, the management of their herds is rational in terms of their overwhelming desire to survive the recurrent droughts of the African savannah. They may succeed in the current efforts to become profit maximizing livestockmen instead of security maximizing herdsmen. As profit maximizers they will be less tolerant of wildlife which imposes costs with no returns, and more responsive to the incentive to manage wildlife which produces returns.

Social change may be less dynamic for the agricultural people who inhabit the wildlife country west of Tsavo park in Kenya. They are reputed to be great poachers but less may be known about their cultural attitudes toward wildlife (Holman 1967). Here we might

[8] At least one East African entrepreneur has demonstrated the potential for imaginative marketing of game skins (Parker 1970).

investigate the application of concessions for territories and the regulation of offtake as has been discussed for the pastoral areas. If we found that these poachers had been operating in regular territories, regularly taking a harvest of animals with no perceptive diminution in the take—and here the leopard is probably the best case in point—then why not legitimize what seems to be a viable production system? The advantages of legitimization would be better prices, better quality furs, and better control of illegal operations.[9]

We would be remiss if we left the impression that the conservation problems of the African countries were entirely under their control. A major part of their problem consists of actions in Europe and North America. The market-oriented approach to wildlife conservation will only work if there are markets for wildlife products. Closure of those markets is the single action which is most likely to lead to speedy elimination of African wildlife outside those parks and reserves which generate substantial revenues from tourism. The most profitable actual and potential markets are in Europe and North America. We are extremely disturbed at the fact that prices for skins of African animals have tended to fall in recent years, simultaneously with enormous increases in prices of wildlife products from the temperate countries, especially northern Canada and Russia (Business Week 1973). We would hazard the guess that an important determinant of this adverse development has been the campaign to get potential consumers of African wildlife products to switch their expenditures to other items, in the mistaken belief that this switch would assist the preservation of the resource. Conservationists' energies would be better spent in assisting the fur trade to develop new and higher priced markets for their products. At the same time, there needs to be much more careful application of administrative controls on imports or processing of particular wildlife products, so that such arrangements do not preclude the opportunity for African Governments to administer sound wildlife management programs involving controlled harvests even of so-called "endangered" species.

CONCLUSIONS

The main objective of wildlife policy in the past was to protect as many animals as possible once it was discovered that certain populations or herds were endangered. Departments were organized to police and enforce a battery of prohibitions regarding wild animals. This

[9] No anthropological studies of this aspect of poaching by agricultural people are available but some evidence of systems of property rights among the American Indians does exist (McManus 1972). Territories among Canadian trappers have been long established (Fuchs 1957).

approach seemed appropriate at the time and perhaps hindsight supports it.

Presently, however, parks and protection are not enough to provide a complete wildlife conservation program. Protection of wildlife in East Africa has led to a system of black markets and smuggling which imposes high costs on the society without either conserving the wildlife resource or providing information and revenues for the government and landowners who would manage wildlife. There may be cases elsewhere where conventional wildlife policies have shown long term success in dealing with overexploitation by poachers. Current policies surely are misapplied where the threat to wildlife is competition from other uses of the land which appear to be more attractive than wildlife.

In short, the well intended concern of conservationists is currently lowering the economic value of wildlife in Africa and is making it less attractive than other forms of land use. If this is a timely observation, it provides the basis for a reformulation of African game policy before ongoing changes in land use become irreversible and eliminate the wildlife. Africa could become the testing ground for new policies of much wider application, not only in developing countries but in industrial countries as well.

There are encouraging initiatives underway in East Africa. We suggest that world conservation leaders recognize the import of these initiatives and review their own approaches to African wildlife conservation. They may then want to reformulate them.

LITERATURE CITED

Beard, Peter.
1965. The end of the game. Viking, New York.
Business Week.
1973. Feb. 17, p. 37.
Crawford, Michael.
1972. Conservation by utilization. Oryx, September.
Fuchs, Victor.
1957. The economics of the fur industry. Columbia University Press, New York.
Graham, Alistair,
1973. Gardeners of Eden. Allen and Unwin, London.
Hayden, Sherman S.
1942. The international protection of wildlife. Columbia University Press, New York.
Holman, Dennis.
1967. The elephant people. John Murray, London.
Krutilla, John V.
1967. Conservation reconsidered. American economic review, September.
Lee, Richard B. and Irven DeVore, eds.
1968. Man the hunter. Aldine, Chicago.
McManus, John C.
1972. An analysis of Indian behavior in the North American fur trade. Journal of economic history, March.
Mitchell, Frank.
1968. The economic value of wildlife viewing as a form of land use. East African agricultural and forestry journal, special issue, June.
Myers, Norman.
1972. National parks in Savannah Africa. Science, 22 Dec.
Parker, I. S. C., and A. L. Archer.
1970. The status of elephant, other wildlife and cattle in Mkomazi Game Reserve, Wildlife Services Ltd., unpublished, Nairobi.

Ramsey, Charles W.
1965. Potential economic returns from deer as compared with livestock in the Edwards Plateau region of Texas. Jour. Range Management, vol. 18(5).
Republic of Kenya.
1969. Development plan 1970-1974. Nairobi.
Schelling, Thomas C.
1967. Economics and criminal enterprise. The public interest, spring.
Steel, W. S.
1968. The technology of wildlife management, game cropping in the Luangwa Valley, Zambia. East African agricultural and forestry journal, special issue, June.
Swank, Wendell.
1972. Wildlife management in Masailand, East Africa. Transactions 37th North American wildlife and natural resources conference.
UNDP/FAO Mission.
1970. Wildlife management in Kenya. FO:SF/Kenya. Rome, August.
Wantrup, S. V.
1952. Resource conservation: economics and policies. University of California Press, Berkeley.
World Wildlife Fund.
1972. Yearbook, Morges.

DISCUSSION

DR. TALBOT: Thank you, Bob, for your provocative presentation. I am sure there are some in the audience who do not agree that one must have an economic basis for wildlife conservation and others who feel this very strongly. Therefore, I would be surprised if there were not some comments forthcoming for this presentation.

MR. ROLAND CLEMENT: I feel, I think as many of us do, that the recent International Treaty on Trade in Rare and Endangered Species is the high watermark of protectionism. I am pleased, however, that the new convention is flexible so that we can use it as a management tool if and when we restore some of the endangered populations to a point where they will stand sustained-yield management. Therefore, I am intrigued by the question that Dr. Davis raises about the African situation.

I agree that we are going to lose the parks, just as was pointed out forcibly recently. I have been there five times in the past ten years and the situation is becoming critical. However, I am concerned, and, of course, this can be developed from testing, but I would like to ask Dr. Davis whether he thinks it possible to manage the total big animal population in East Africa, because I am convinced that lions and elephants are things that the tourists come for. In other words, can these big species be worked into a broad corporate-type management such as you have in mind?

DR. DAVIS: I have the same question. I am better at asking them than answering them. However, there is some reason to believe that destructive species can be incorporated into this concept. It is a matter, partly, of working out transactions so that this can be done.

As a matter of fact, it should be possible to take into account the presence of elephants and of lions, which, of course, eat livestock and this makes the lion the natural enemy of the stockman. On the other hand, there are some very high values to be demonstrated for lions, primarily to sportsmen for trophies. The lion is the number one attraction insofar as tourists are concerned and the tourist values and the sports values together, I think, more than compensate for the livestock that the lions kill. I am sure we can work out a method of compensation.

MR. LARRY HARRIS: Dr. Davis, I am very sympathetic to your appraisal of the situation. However, I wish that you as a resource economist would give us some leadership in breaking the dichotomy of economics between what is economic and what is monetary. We are possibly missing the boat by not playing on some nonmonetary economic valuation and it seems to me that your plea for monetary economics is one which I do not want to see purveyed as a form of conservation.

DR. DAVIS: I am a reluctant market man, which means that I wish there were a better way to go. However, given things as they are, they are the best that they can be.

For example, given the situation in East Africa, I think the choices are pretty plain and we have to shut our eyes to any dichotomy that may exist between economic and monetary and go the monetary route at the moment.

However, we were also in this state in relation to this country a hundred years ago. We have come through it. We are not talking about the nonmonetary, the nonmarket, the extra market values of wildlife. If we can hold on to the resources in East Africa and if there is economic development, as government supporters hope for, then I think we can use monetary dollars to good advantage and move on to the next stage in time.

I agree this is not a very pleasant prospect but I think it is the best choice we have.

MR. HARRIS: I would make one more comment. I would suggest that what you are saying is to be a part of the problem right now—namely, Africans are not willing to accept the monetary value system and that we must appeal to things which are dear and familiar to them and, indeed, this has been given to us by Leopold and others forty years ago—that conservation depends upon basic human drives.

DR. DAVIS: That is a basic human drive and it is particularly basic among the people who are not affluent but who are, for a variety of reasons we could discuss and debate, people who are being directed and self-directed along the path of economic development. The attitudes and value systems we are able to have in the West are luxuries to the East African people at this stage in history, and this is a point which we must recognize and step outside of our own value system to ask what the value system of the African people and nations are today.

MR. GARY BELOVSKY: How do you propose an economic management of land with economic systems to be already in operation? In other words, I cannot understand how you can propose an economic system for wildlife management, such as for the spotted cats, where the approach seemed to be motivated by economic management values already.

DR. DAVIS: What I am saying is that economic systems exist and if, as some researchers are now suggesting, the leopard, for example, seems to be holding its own under existing exploitation pressure, then does this not suggest we may have manageable, harvestable resources on the land?

If you need evidence that trade exists in the spotted cat, you only have to call the Department of the Interior and ask about their recent discoveries about the trade and smuggling.

What we are asking, on the other hand, is whether it is wise to force this trade underground, where it could not but continue as an unknown quantity, or whether it is wise to bring it above ground so that we know what is going on and can work with it.

MR. BELOVSKY: That may be true but the problem here, is that you are losing population through decline and, even if you bring it above ground, there is still motivation for people to hunt animals because they have high value on the market.

DR. DAVIS: There may be some question about whether some of these populations are declining or holding their own.

The second point is that we are in the situation where everybody has to get his now because there will not be any left for the taking if he waits. Therefore, the key problem is dealing with the property rights, the common property aspects of the wildlife resource.

If we can make property rights specific; if, for example, we find territorialism among leopard poachers similar to territorialism that existed among Canadian trappers for years, then a system of property rights does exist and an individual has an incentive to control poaching whereby, in his definition, anyone else is poaching in his territory, then we may have a viable system through which to perpetuate the resources, even though they are commercialized.

On the other hand, whether it should be commercialized or not, that is another question.

DR. TALBOT: I think the convention is very pertinent here.

The convention recognizes several classes of species and situations. It did not say it was black and white, but rather, that some species are so seriously endangered that any economic trade would tend to push them off the brink; therefore, there should be no economic trade. Further, the convention seeks to stop

any such trade through the cooperation of the various countries, consumers along with the producers. This recognizes, in addition, that you cannot get anywhere trying to deal with the problem from one side alone.

The convention also recognizes that there are many situations where trade is perfectly legitimate so long as it is controlled but that uncontrolled, again, with the same processes of demand the supply, it will push the species down to the point where it does indeed become threatened. In these cases the convention seeks to set up a mechanism of monetary and regulating control—not stopping all trade and not negating the economic factors in these cases, but indeed seeking to turn over the economic factor by getting at the market place on those species that are critically endangered.

EFFECTIVE TECHNIQUES FOR DEVELOPING WILDLIFE RESERVES IN LATIN AMERICAN COUNTRIES

ANNE LABASTILLE
Ecological Consultant and Writer, Big Moose, New York

The remarks and recommendations which are presented in this paper are based on my direct participation in three conservation field projects in Central America between 1965 and 1972. During this period, I also visited numerous wildlife refuges, national parks and equivalent reserves in Central America, Mexico and the Caribbean area. The three projects involved setting up reserves in several different ecosystems, each with one or more rare and endangered species of wildlife, using various methods and sources of funding. The purpose of this paper is to make a comparison of these projects, to draw a few objective and subjective inferences about effective techniques, and to evaluate methods used to establish these reserves.

The first reserve is a small national wildlife refuge in the highlands of Guatemala, developed specifically to protect and manage a rare and endangered, flightless waterbird—the Atitlan grebe, *Podilymbus gigas*—which is endemic to Lake Atitlan. There are approximately 210 birds alive. This aquatic ecosysem is surrounded by a high-density population of indigenous Mayan Indians. The reserve area covers four to five acres on the south shore of a lake 65 miles in circumference. The entire lake is technically a waterfowl refuge. Project A was initiated largely through my personal scientific interest in this unique species, especially when the grebe seemed headed for extinction in 1965.

It was fairly easy to introduce the idea of a conservation and management program to the Minister of Agriculture in Guatemala City. Over the next four years, funding came from international sources such as World Wildlife Fund-Switzerland, the International Council for Bird Preservation, Smithsonian Institution, National Geographic Society, and the Wildlife Management Institute. Matching funds

were provided by the Ministry of Agriculture in Guatemala for many aspects of the program. The services of six wildlife technicians (an all-inclusive word which included the regular government and honorary game wardens, the chief of the Division of Fauna, the director of the Natural History Museum, and myself) and six Indian workmen were utilized in the project. Time-wise it involved two years to establish the reserve. It has been continuing for five more years under auspices of the Division of Fauna.

Project B concerns the establishment of a large national park in western Panama, incorporating an entire volcano above 5000 to 8000 feet to the summit at 11,400 feet. Volcano Baru National Park includes at least three separate ecosystems within an area of almost 38,000 acres. Only scattered human habitations dot the lower slopes of the volcano, either farms or ranches whose property stretches across the tentative park boundary, or the huts of loggers and squatters. Many species of tropical wildlife occur here. Most spectacular is the rare and endangered quetzal, *Pharomachrus mocinno,* a beautiful trogan which reaches the southernmost limit of its range in western Panama.

This project was initiated by Dr. Gerardo Budowski, Director General of the International Union for Conservation of Nature and Natural Resources (IUCN), and the former Minister of Agriculture and Ranching in Panama. It has been, or is being, partially supported and funded by the Food and Agricultural Organization (FAO), World Wildlife Fund—US Appeal, IUCN, the Panamanian Ministry of Agriculture and Ranching through its Department of Natural and Renewable Resources (RENARE), and the U.S. National Park Service. My imput was to conduct an ecological survey of the park area last year (February 1972) and to make a report with recommendations for wildlife management. This survey utilized seven wildlife technicians and one photographer and involved one month in the field and two months writing up the report. Actual development of the national park will take two to five years after its official declaration. Responsibility will rest with the Ministry of Agriculture's Park Service and FAO.

Project C is a medium-sized private reserve situated in southwestern Guatemala and includes 1000 acres of mountainous virgin cloud forest. The key rare and endangered wildlife species are the quetzal and the horned guan, *Oreophasis derbianus.* This magnificent area is completely wild, undeveloped and without human habitation, although farm laborers occasionally venture into the cloud forest on hunting trips. Future plans call for an expansion of several hundred more acres of cloud forest.

This project was initiated because of a National Geographic expedition to the area in 1968 to photograph and study the quetzal for an article. The landowners became intrigued and interested in protecting the birds. Fortunately, I was able to keep this interest stimulated until funds could be obtained from World Wildlife Fund—US Appeal, and the Cleveland County Bird Club of Oklahoma. Field establishment took one month, legal arrangements and organization one year. Sole responsibility and control of the reserve lies with the landowners who have officially donated the property to the Association Atitlan for the Protection of the Quetzal. This legal entity is composed of landowners and conservation-minded members.

With this thumbnail sketch of Reserves A, B, and C, let us examine the similarities and differences. In all three cases reserves were set up in developing countries where little expertise existed in wildlife management and conservation. All three areas contain rare and endangered wildlife species of unique quality and good examples of their habitats. In each case, the species or the ecosystems was threatened. At Reserve A of Lake Atitlan, introduction of largemouth bass and poaching were jeopardizing the very existence of the flightless grebes. On Reserve B, Volcano Baru, agricultural and ranching and timber concerns were nibbling at the upper slopes of prime montane forest. In Reserve C, the cloud forest, private plantations were enchroaching up the mountainsides and workmen were hunting whenever possible. A certain amount of information on the ecology and management of the key endangered species was available. Outside funding and professional assistance were necessary in all three projects.

As is obvious, the differences among the three reserves are ones of size, ecosystems, the degree of human use, wildlife species, sources of funding, organizations maintaining control, and the time involved.

A number of recommendations can be drawn from these projects suggesting techniques for successfully establishing wildlife reserves in Latin American countries.

A. Whenever possible, a rare and endangered species should be chosen as a key symbol upon which to focus local attention, public sympathy, fund-raising campaigns, publicity and educational efforts. For example, the quetzal, which is the national bird of Guatemala, became the *raison d'etre* for establishing the cloud forest reserve, and it may be the key attraction to tourists at the proposed Volcano Baru National Park in Panama. The Atitlan grebe was used as the motif for three airmail conservation stamps (sales grossed $123,000), arts and crafts, and conservation education in Indian schools in Guatemala.

B. It must be recognized that enthusiastic personnel from outside

sources may be needed to provide professional expertise at the beginning of any project; however, the real initiative and concern must come from within the country and from its national talent. A reserve cannot and should not be established if it runs counter to national and local interests.

C. Outside funds and international cooperation should be judiciously utilized, recognizing that they add dimension to the project, give a psychological importance to the cause, and often serve to spark off matching funds or fund-raising campaigns within the country. This certainly proved true with the grants brought into Guatemala to preserve the Atitlan grebe.

D. Any foreign wildlife professional working in another country should place great emphasis on diplomatic interpersonal relations. "Scientific imperialism" (to quote a term of Dr. Budowski's) should be avoided. Every effort should be made to establish an atmosphere of equality and ease with native colleagues irregardless of academic and financial backgrounds. It is almost essential to speak the native language, to develop a sensitivity to the existing time dimension, and to have a fundamental understanding of the local customs and morays.

E. Technical advice and equipment which is brought into a country in Latin America for a wildlife reserve should be simple, inexpensive and easy to operate. For example, an inexperienced game warden should not have to use a 50-horse outboard motor and fiberglass boat when he or she does not know how to swim. A modestly trained wildlife technician should not have to operate sophisticated tape recording or radio monitoring equipment when there is no way to obtain batteries or electricity.

F. Local talent should be involved with the project from the start with on-site practical training conducted at the reserve. This will raise the local economy and prestige, gain publicity for the program, and at the same time decrease apprehension and dependency on outside assistance.

G. Accurate and lively news coverage must be obtained during the establishment of any wildlife reserve since this is one of the fastest, cheapest and most effective means of educating the literate people in the cities. (Other methods are often necessary for illiterate rural people). Such publicity often leads to excellent support from unexpected organizations and persons. On the Volcano Baru survey, a professional photographer accompanied our team for the express purpose of providing complete photo coverage of the area and the ecological work. These pictures have already been used in Panamanian newspapers and a forestry fair, in my scientific report to the Minister, and for a tourist brochure and lectures.

H. It should be recognized that the most realistic justification for establishing wildlife reserves in developing Latin countries—effective wildlife reserves—is for increased economic benefits and national pride. Also, where feasible, for recreational use by the people and protection of the watershed, soils or water. Justifications based on pure preservation, esthetics, or the maintenance of ecological diversity are fairly affluent points of view and difficult to employ as convincing arguments.

I. Once the reserve is established, full responsibility for its management and funding should be turned over to the national organization in charge. The foreign professional should not prolong his or her stay, "baby-sitting" as it were, on the new reserve, no matter how attached to the project. A certain amount of ceremony, such as an inauguration, press releases, or an official visit by Government dignitaries, may be advisable. This way the act of assuming responsibility becomes psychologically enjoyable and important.

J. The old adage—"The price of freedom is eternal vigilance"—must always be remembered in effective conservation programs. The price of effective conservation is continued surveillance. This may best be accomplished by the reward system. Foreign dignitaries might send congratulatory letters to the organization in charge of the reserve; reprints, books and small pieces of equipment pertinent to the reserve may be sent from time to time to reserve personnel; beneficial publicity abroad can be arranged and forwarded to reserve headquarters. These rewards usually have an invigorating effect. Likewise, a foreign professional can return occasionally to the reserve he or she helped establish for purposes of making a new census, up-dating a certain piece of data, or obtaining current photos, without offending or embarrassing local personnel; yet this person's very presence will have a tonic effect on the entire project. So will spontaneous and unsolicited donations ear-marked for special aspects of the reserve.

In conclusion I should like to evaluate the effectiveness of these three reserves. Reserve A at Lake Atitlan has been operating for five years. It has received a few hundred visitors a year by water, and a new road to the reserve will allow added visitation by land. A new patrol boat and motor have been donated by World Wildlife Fund—US Appeal, to the game warden for patrol work. Local Mayan Indian inhabitants appear to have learned from conservation education efforts and respect the program. The flightless grebes have increased and are flourishing.

Reserve B still awaits official declaration by the President of Panama; however, detailed plans for park development are complete (based on a U.S. National Park Service plan) and ready to be imple-

mented. Currently, public contacts around the area are being made to educate the public to the benefits of the national park.

Reserve C is essentially complete until the next private donation of land is made. Since this reserve is maintained strictly as a scientific sanctuary, there is very little visitation or construction. Both quetzals and cloud forest are in good condition.

Based on these conclusions, I would summarize that the easiest, fastest and perhaps most effective method to establish new reserve areas for wildlife is to develop them on private lands with cooperative, wealthy landowners. A legal association should be used to handle funds and to ensure the future longevity of the reserve. Such a reserve should not be overly large in order to avoid problems of patrol, enforcement and possible government nationalization. The second most effective, though slower, approach is to establish a large national park or equivalent reserve using substantial international support and funding in the beginning and offering economic advantages, national pride and public recreation as incentives. The hardest and slowest method appears to be that of developing a small, isolated national reserve which features only one wildlife species and habitat. Location may pose a problem to people who lack private transportation or cannot afford public travel. A small reserve may also come under the responsibility of personnel who lack extensive training and insight and are unable to plan for the future because of their position in the hierarchy of government.

In the final analysis, all three methods are feasible if they can be judged from the relative success of these three wildlife reserves. The really critical factors are that responsibility rests in local hands which are willing, competent and enthusiastic; and that cordial and helpful relationships with foreign colleagues are nurtured and maintained across the miles and the years.

DISCUSSION

DR. TALBOT: Thank you very much. This is the kind of paper I particularly appreciate and I am sure the rest of the wildlifers in the audience do also. This is one whose illustrations and speaking ability are highly decorative as well as highly effective.

She has brought us down to another of the specific details of one basic approach to the conservation of endangered species in Latin America and this really applies to many of the developing countries.

MR. DOUGLAS SCOTT: From listening to some of these papers in relation to projects that are done in foreign countries by Americans and people from western countries, one thing that seems to bother me more than anything else is the attitude that we seem to take toward some of these countries. It seems to me that possibly a more fruitful approach would be to go to some of the scientists in these countries and work more closely with those people and try to get them to help themselves rather than constantly having to reinforce these projects and constantly

having to send in materials and so on. This is something that could be developed in the country with just a little input from our side. This is the point that I seem to read in many papers and hear in many talks, especially from papers being presented from the western countries.

DR. TALBOT: One of the important points that was brought out here, especially in relation to what the gentleman from the floor says, was the importance of developing local awareness and building and supporting local expertise concerning capability rather than coming in with a paternalistic attitude. I believe this was also what Bob Davis was emphasizing when he indicated strongly that you have to fit the conservation approach to the economic and social conditions and build it into the land use of the country involved.

One of the most effective ways that some of us have found to be able to do this in working in other countries is to try to identify, first, the concern and the expertise.

Frequently, there is a scientist or a group of scientists, some workers in government, but usually far down in the hierarchy, who, as a matter of fact, are not recognized in the power structure and whose concern with conservation is not shared by those above them. Most of the developing governments are characterized by a fairly centralized decision-making system as opposed to a grass roots, democratic system.

Now, if one can identify these people within the country and then be able to support them, saying essentially the same thing they have been saying all along, but to their superiors or their government, it is possible, if one is careful, to very greatly assist in building the capability within the country. It is a sort of unwritten law of nature that if somebody who comes in from outside says that he is an expert and is more expert than someone who has spent his life in the country, you may be in for difficulty. As a matter of fact, you might say that the same thing holds within our own government and in this country. In other words, there is a very fine line between the paternalistic, big brother coming in and telling the country what to do and those of the country who support the local conservation concerns.

* * *

COMPARATIVE PRODUCTIVITY OF SIX BALD EAGLE POPULATIONS

ALEXANDER SPRUNT, IV
National Audubon Society, Tavernier, Florida;

WILLIAM B. ROBERTSON, JR.
National Park Service, Everglades National Park, Florida;

SERGEJ POSTUPALSKY
Department of Wildlife Ecology, University of Wisconsin, Madison;

RICHARD J. HENSEL
Bureau of Sport Fisheries and Wildlife, Anchorage, Alaska;

C. EUGENE KNODER
National Audubon Society, Tavernier, Florida; and

FRANK J. LIGAS
National Audubon Society, Naples, Florida

Charles L. Broley (1958) reported a drastic decline in a bald eagle (*Haliaeetus leucocephalus*) population during the late 1950's. He documented a marked reduction in the number of breeding pairs and the reproductive rate of the remaining pairs. In response to increasing concern for the future of the species the National Audubon Society began to investigate the bald eagle over most of its range in 1960. The studies reported here have been closely coordinated with, or are integral parts of, a long-term program to determine the status and examine the ecology of the bald eagle.

Knowledge pertaining to the bald eagle has been meager except for the findings of Francis H. Herrick (1924, 1932, 1933, 1934). Herrick's monumental contribution, with the casual effort of others, has helped to sketch an outline but many gaps exist. Bald eagles build large conspicuous nests, usually in trees and to a lesser extent along cliffs or on sea stacks. The usual clutch size is two eggs but one and three eggs are common with clutches of four having been reported by oologists. After an incubation period of 34 or 35 days (Herrick 1934) the young remain in the nest 10 to 12 weeks before fledging. After leaving the nest young eagles depend on parental care for several weeks and often return to the nest for food. Broley's (1947) banding results indicated that young eagles may move long distances after becoming self sufficient.

It is impossible to ascertain the "normal" reproductive rate of the bald eagles due to the lack of definitive studies. Two studies, however, offer some insight of what it might have been in past years. The first by W. Bryant Tyrrell (1936) was conducted during a single year near

Chesapeake Bay. His observations on 53 active nests revealed that 46, or 87 percent, were successful with 95 young produced, for a reproductive rate of 2.1 young per successful nest and 1.8 young per active nest. Broley's (1947) work from 1939 through 1946 also exhibited a high success rate with 448 productive nests in 619 attempts for a success rate of 72 percent over a six-year period. Analysis of Broley's figures for 384 of these attempts, which he reports in more detail, indicates that on the average 1.66 young were produced from each successful nest and 1.23 from each active nest. Both the percentages for successful nestings and the number of young raised reported by Tyrrell and Broley are higher than any found during the present investigations.

It is of course possible that prior to 1946 productivity was higher than has been recognized but a bias has been noted by the present authors which might explain the high success rates reported in the above works. Tyrrell worked entirely from the ground, traveling by car, boat and afoot. He started late in the season and located nests over an extended period. Broley was interested in banding young birds and often depended on other persons for information pertaining to the earlier stages of the breeding season. Because of these circumstances eagles failing early in their cycle could have been overlooked and nests recorded as unoccupied for that year. This would inflate the rate of success. Broley's figures, gathered over several years and based, in part, on actual climbs to the nests, probably show less bias. They are indeed closer to the upper limits of production reported in the present paper.

METHODS AND DEFINITIONS

The same basic methods of gathering data were used in the studies reported here. During the earlier work in Maine, Michigan, and Wisconsin, nests were located and checked from the ground, but light aircraft were used in these areas after 1962 and throughout the studies in Florida and Alaska. The type of plane varied with time and location, but observations were made at low altitude and at slow speed. This provided an excellent opportunity to observe nest contents which are quite difficult to see from the ground. Incubating eagles pay little attention to fixed-wing aircraft so it was often impossible to see eggs. If an adult was on the nest in a typical incubating posture, eggs were assumed to be present.

At least two checks of the nests were made during each nesting season. The first was made early in the breeding cycle to determine which territories contained adults at nests, and the second at a stage when fledglings 6 to 10 weeks old could be distinguished. Little

mortality of young birds occurs after this period so nestlings counted during the second visit were assumed to have fledged.

Because of the difficulty in working with bald eagles, whose nests are often inaccessible, some of the usual methods of reporting reproductive success, such as the number of young produced from a known number of eggs, become impractical. Thus, a clear understanding of the terms used to report nest status in this paper is essential.

Breeding bald eagles occupy a definite territory containing one to several nests for which they show a high degree of tenacity over a period of years (Howell 1954, 1958, 1968, and Howell and Heinzmann 1967). The following terms and definitions are based on those discussed at the Bald Eagle Symposium held in 1965 at Port Clinton, Ohio and first committed to paper by Postupalsky (1967).

The terms *active territory* and *active nest* are used here to indicate the same condition: the presence of a pair of eagles during the breeding season in a territory which contained a nest. If a nest was occupied by an incubating eagle, or if eggs or young were seen, the presence of an adult pair was assumed. A *successful nest* is a nest from which at least one young fledged. Only those territories whose outcome in a given year was known are included.

The intensity of coverage in the six areas differed. Because of the high number of active territories (about 200) located within the large Kodiak National Wildlife Refuge and the limitations of manpower and equipment, only about 20 percent were sampled. In the Everglades National Park repeated coverage over an extended period of time and the low rate of new nest discoveries indicated that probably at least 95 percent of the nests occurring in the area were censused. The diminishing rate of discovery of new sites as the study progressed in Wisconsin, Michigan and Maine also indicated that samples approached the actual number of breeding pairs. For an overall average, however, the coverage throughout the time reported in this paper in the latter areas is estimated at 80 percent of the actual population.

This study included a total of 2036 nesting attempts over a 7 to 12-year period.

RESULTS

At the inception of the Bald Eagle Project, one of the first tasks was to ascertain the distribution of nesting and wintering populations. The results of these surveys have been published in various progress reports (Sprunt and Cunningham 1961, 1962; Sprunt and Ligas 1963, 1966). Information for the eastern half of the United States showed that significant breeding populations could still be found in Florida, the Chesapeake Bay area, Maine, and the western

Great Lakes States. Alaska, particularly southeastern Alaska, supported, probably as it always had, the largest breeding population of the species.

It became evident that eagles were reproducing at different rates according to locality so detailed studies were undertaken in specific areas with pertinent findings presented in Figure 1 and Table 1.

Eagles on the Kodiak National Wildlife Refuge were chosen as an example of Alaskan populations. They nest here in cottonwood trees bordering lakes and streams and along seaside cliffs or rocky islets (Troyer and Hensel 1965). This large eagle population is believed to represent as nearly a normal situation as presently exists for this species. A productivity sample for this group is in Table 2.

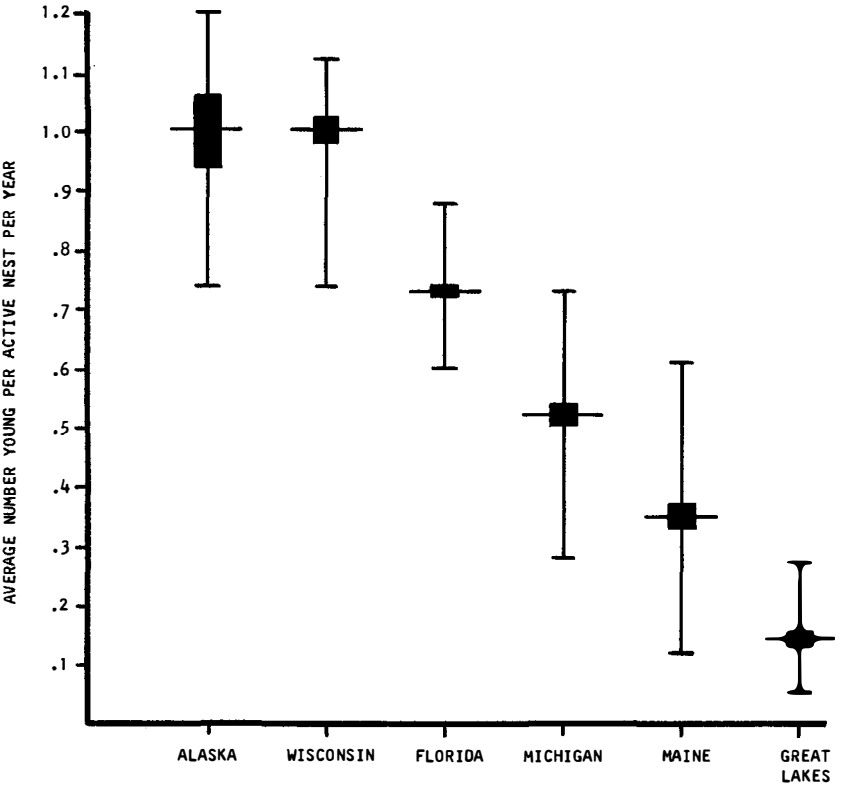


FIGURE 1. COMPARATIVE REPRODUCTIVE SUCCESS OF SIX BALD EAGLE POPULATIONS.

Rectangles represent standard errors of the means, vertical lines the observed ranges.

TABLE 1. COMPARATIVE PRODUCTIVITY OF SIX BALD EAGLE POPULATIONS

Population	Percent Nests Fledging Following Number Young				Total Number Nests	Number Years Data	Percent Nests Successful	Av.No.Yng. Successful Nest	Av.No. Yng.Active Nest/Yr.	Standard[5] Error
	0	1	2	3						
Alaska[1]	37	27	35	2	312	7	63	1.60	1.00	0.06
Wisconsin	34	33	30	3	492	9	66	1.55	1.00	0.02
Florida[2]	50	29	20	1	592	12	50	1.45	0.73	0.01
Michigan[3]	63	24	11	2	243	10	37	1.39	0.52	0.02
Maine	73	20	7	0	241	9	26	1.29	0.35	0.02
Great Lakes Shores[4]	90	8	3	0	156	10	10	1.31	0.14	0.01

1. Kodiak Island
2. Everglades National Park
3. Lower Peninsula only, excluding nests on Great Lakes
4. Michigan and Wisconsin shorelines, including Isle Royale
5. Adjusted using "finite population correction" (Snedecor and Cochran, 1967)

TABLE 2. PRODUCTIVITY OF BALD EAGLES AT THE KODIAK REFUGE, ALASKA

Year	Number Active Territories	Number Successful Nests	Percent Successful Nests	Total Number Young	Av. No. Young Fledged/ Successful Nest	Av. No. Young Fledged/Active Nest	Number and Percent of Nests Fledging Following Number of Young							
							0	%	1	%	2	%	3	%
1963	76	49	66	81	1.65	1.06	27	36	20	26	26	34	3	4
1964	45	22	50	37	1.68	.82	23	51	8	18	13	29	1	2
1965	35	19	54	26	1.37	0.74	16	46	12	34	7	20	0	0
1966	39	24	63	38	1.58	0.97	15	38	10	26	14	36	0	0
1967	54	37	69	63	1.70	1.17	17	32	11	20	26	48	0	0
1968	35	24	68	42	1.75	1.20	11	31	8	23	14	40	2	6
1969	No data - eggs collected this year													
1970	28	22	79	30	1.36	1.07	6	21	14	50	8	29	0	0
Totals:	312	197	63	317	1.61	1.02	115	37	83	27	108	35	6	2

One of the more surprising discoveries was that populations nesting fairly close together, or even contiguously, were reproducing at quite different rates. This is clearly demonstrated by the populations of the western Great Lakes States. Three discrete populations were recognized in Michigan and Wisconsin. One is located in the northern two tiers of counties in Wisconsin, away from the shores of the Great Lakes. This population was still reproducing at a rate presumed to be close to normal (Table 3).

A second population is located in the inland (again, away from the immediate shores of the Great Lakes) portion of the Lower Peninsula

TABLE 3. BALD EAGLE PRODUCTIVITY IN WISCONSIN

Year	Number Active Territories	Number Successful Nests	Percent Successful Nests	Total Number Young	Av. No. Young Fledged/ Successful Nest	Av. No. Young Fledged/Active Nest	Number and Percent of Nests Fledging Following Number of Young							
							0	%	1	%	2	%	3	%
1962	25	17	68	28	1.65	1.12	8	32	6	24	11	44	0	0
1963	38	24	63	40	1.69	1.05	14	37	9	24	14	37	1	3
1964	27	17	63	24	1.41	0.89	10	37	10	37	7	26	0	0
1965	35	21	60	26	1.24	0.74	14	40	16	46	5	14	0	0
1966	63	43	68	70	1.63	1.11	20	32	19	30	21	33	3	5
1967	72	49	68	70	1.43	0.97	23	32	30	42	17	24	2	3
1968	67	46	69	73	1.59	1.09	21	31	20	30	25	37	1	1
1969	83	60	72	93	1.55	1.12	23	28	33	40	21	25	6	7
1970	82	47	57	78	1.66	0.95	35	43	19	23	25	30	3	4
Totals:	492	324	66	502	1.55	1.02	168	34	162	33	146	30	16	3

TABLE 4. PRODUCTIVITY OF BALD EAGLES IN THE INLAND LOWER PENINSULA OF MICHIGAN

Year	Number Active Territories	Number Successful Nests	Percent Successful Nests	Total Number Young	Av. No. Young Fledged/ Successful Nest	Av. No. Young Fledged/Active Nest	Number and Percent of Nests Fledging Following Number of Young							
							0	%	1	%	2	%	3	%
1961	20	7	35	10	1.42	0.50	13	65	4	20	3	15	0	0
1962	24	8	33	12	1.50	0.50	16	66	4	17	4	17	0	0
1963	21	5	23	6	1.20	0.28	16	76	4	19	1	5	0	0
1964	26	11	57	19	1.72	0.73	15	58	4	15	6	23	1	4
1965	28	9	32	12	1.33	0.42	19	68	6	21	3	11	0	0
1966	27	12	44	16	1.33	0.59	15	56	9	33	2	7	1	4
1967	30	11	36	15	1.36	0.50	19	63	8	27	2	7	1	3
1968	26	10	38	15	1.50	0.57	16	61	6	23	3	12	1	4
1969	22	9	40	11	1.22	0.50	13	59	7	32	2	9	0	0
1970	19	9	47	11	1.22	0.58	10	53	7	37	2	11	0	0
Totals:	243	91	37	127	1.39	0.52	152	63	59	24	28	11	4	2

of Michigan. Reproductive success of this population was considerably lower than that noted in Wisconsin (Table 4).

The third population consists of those nesting close to the shores of the Great Lakes proper and where breeding eagles probably draw a large proportion of their food from the lakes. Production of young eagles is lower in this group of nesting pairs than in any other so far studied (Table 5).

Florida has more breeding bald eagles than any state except Alaska. In the Everglades National Park a population of approximately 50 to 55 pairs has been studied perhaps more thoroughly than any other breeding group. The availability of personnel and aircraft here led to a more careful assessment of this population than has been possible elsewhere (Table 6).

TABLE 5. PRODUCTIVITY OF MICHIGAN AND WISCONSIN GREAT LAKES BALD EAGLE NESTS

Year	Number Active Territories	Number Successful Nests	Percent Successful Nests	Total Number Young	Av. No. Young Fledged/ Successful Nest	Av. No. Young Fledged/Active Nest	Number and Percent of Nests Fledging Following Number of Young							
							0	%	1	%	2	%	3	%
1961	14	1	7	1	1.00	0.07	13	93	1	7	0	0	0	0
1962	14	1	7	2	2.00	0.14	13	93	0	0	1	7	0	0
1963	20	2	10	4	2.00	0.20	18	90	0	0	2	10	0	0
1964	18	1	6	1	1.00	0.05	17	94	1	6	0	0	0	0
1965	16	1	6	1	1.00	0.06	15	94	1	6	0	0	0	0
1966	25	4	16	5	1.25	0.20	21	84	3	12	1	4	0	0
1967	21	1	5	2	2.00	0.10	20	95	0	0	1	5	0	0
1968	11	3	27	3	1.00	0.27	8	73	3	27	0	0	0	0
1969	12	1	8	1	1.00	0.08	11	92	1	8	0	0	0	0
1970	5	1	20	1	1.00	0.20	4	80	1	20	0	0	0	0
Totals:	156	16	10	21	1.31	0.13	140	90	11	8	5	3	0	0

TABLE 6. PRODUCTIVITY OF BALD EAGLES IN THE EVERGLADES NATIONAL PARK

Year*	Number Active Territories	Number Successful Nests	Percent Successful Nests	Total Number Young	Av. No. Young Fledged/ Successful Nest	Av. No. Young Fledged/Active Nest	Number and Percent of Nests Fledging Following Number of Young							
							0	%	1	%	2	%	3	%
1961	45	20	44	29	1.45	0.64	25	56	11	24	9	20	0	0
1962	45	22	49	30	1.36	0.67	23	51	14	31	8	18	0	0
1963	51	31	61	42	1.35	0.82	20	39	20	39	11	22	0	0
1964	50	28	56	40	1.43	0.80	22	44	18	36	8	16	2	4
1965	50	26	52	41	1.58	0.82	24	48	12	24	13	26	1	2
1966	52	25	48	34	1.36	0.65	27	52	16	31	9	17	0	0
1967	50	27	54	39	1.44	0.78	23	46	16	32	10	20	1	2
1968	47	27	57	35	1.30	0.74	20	43	20	43	6	13		2
1969	52	22	42	34	1.55	0.65	30	58	11	21	10	19		2
1970	46	24	52	39	1.63	0.88	22	48	9	20	15	33	0	0
1971	51	24	47	35	1.46	0.69	27	53	14	27	9	18	1	2
1972	53	20	38	32	1.60	0.60	33	62	8	15	12	23	0	0
Totals:	592	296	50	430	1.45	0.73	296	50	169	29	120	20	7	1

*Bald eagles in the Park nest during the winter months. Therefore, a reproductive season encompasses 2 calendar years. As shown here, 1960 is actually 1959-1960; 1961 is actually 1960-1961, etc.

Another significant breeding population occurs in Maine at the other end of the Atlantic seaboard. Most bald eagles in Maine inhabit estuarine zones with only a remnant number of pairs still in the interior (Table 7).

Two factors were responsible for the observed difference in reproductive rates: (1) in populations with reduced productivity, a lower percentage of pairs produced young annually, (2) successful pairs in more productive populations fledged, on the average, more young annually than those in less productive populations. Both were significantly associated with variability in productivity [2×6 contingency

TABLE 7. PRODUCTIVITY OF BALD EAGLES IN MAINE

Year	Number Active Territories	Number Successful Nests	Percent Successful Nests	Total Number Young	Av. No. Young Fledged/ Successful Nest	Av. No. Young Fledged/Active Nest	Number and Percent of Nests Fledging Following Number of Young							
							0	%	1	%	2	%	3	%
1962	27	8	30	8	1.00	0.30	19	70	8	30	0	0	0	0
1963	32	9	28	12	1.33	0.38	23	72	6	19	3	9	0	0
1964	28	6	21	6	1.00	0.21	22	79	6	21	0	0	0	0
1965	33	4	12	4	1.00	0.12	29	88	4	12	0	0	0	0
1966	28	7	25	11	1.57	0.39	21	75	3	11	4	14	0	0
1967	21	4	19	6	1.50	0.29	17	81	2	10	2	10	0	0
1968	18	9	50	11	1.22	0.61	9	50	7	39	2	11	0	0
1969	24	9	38	12	1.33	0.50	15	63	6	25	3	13	0	0
1970	30	8	27	11	1.38	0.37	22	73	5	17	3	10	0	0
Totals:	241	63	26	81	1.29	0.35	177	73	47	20	17	7	0	0

tables, $\chi^2 = 236.3, 29.8$ for factors (1) and (2) respectively, 5 d.f., $p<.001$]. Since productivity per active nest is the product of factors (1) and (2), the more important factor is that which has the larger variance. Factor (1) has the larger variance (.05 versus .02). Therefore the percentage of successful pairs was a more important factor than the number of young per successful nest.

Annual fluctuations in reproductive success in four of the six populations were positively correlated with each other (Table 8). In five of the six possible paired comparisons of reproductive rates between the Alaska, Wisconsin, Great Lakes and Maine populations, the correlation was significant at $p<.10$. The sixth (Wisconsin and Great Lakes) was suggestive of the same generalization. In addition, the reproductive rate in Wisconsin was negatively correlated to that of Florida ($p<.05$).

DISCUSSION

Of the six populations studied, three are declining in numbers and three are apparently stable. The number of breeding pairs comprising the inland Michigan, Maine and Great Lakes populations is declining. This is not apparent from the data presented here but the annual loss of pairs is obvious to investigators in the field. The loss is masked by a number of factors: the number of nests censused each year varied with the intensity of effort and was further affected by such elements as timing and weather. Also, new nests were continuously being found although the number has been sharply reduced in recent years. New nests do not necessarily indicate recent additions to the breeding population; they are quite likely to represent traditional sites not previously located. Eagles sometimes move to alternate nests between seasons and may not be discovered immediately. In areas where

TABLE 8. CORRELATION MATRIX
FOR REPRODUCTIVE SUCCESS IN SIX BALD EAGLE POPULATIONS

	Alaska	Wisconsin	Florida	Michigan	Maine	Great Lakes Shores
Alaska[1]	1	.73*	-.12	-.12	.80**	.71*
Wisconsin[2]		1	-.71**	.03	.77**	.54
Florida			1	-.09	-.39	.11
Michigan				1	.02	-.09
Maine[2]					1	.71**
Great Lakes Shores						1

Degrees of freedom = 8 except where noted

[1] d.f. = 5

[2] d.f. = 7

*$p < .10$

**$p < .05$

coverage is not intensive this can lead to problems in arriving at accurate population estimates.

It appears that in a given population, at least 50 percent of the breeding pairs of bald eagles must be productive and that the population as a whole must produce at least 0.7 young per active nest in order to maintain stability.

Due to the limited number of degrees of freedom (5-8) interpretation of the correlations of annual productivity in the various populations must be considered speculation (Table 8). It appears, however, that several populations, spread over a wide area, may be affected by a common factor. Postupalsky (1967) has commented on an apparent relationship between the severity of the weather during the winter preceding a given breeding season and the overall success of that season.

The marked negative correlation between the productivity of Wisconsin and Florida remains unexplained.

The reasons for the large differences in the reproductive rates of some of the bald eagle populations discussed in this paper have been examined in some detail. The principal factor seems to be the relative

contamination of the various populations with hydrocarbon pesticides, principally DDT and its metabolites. The evidence for this will be presented in another paper in the near future.

ACKNOWLEDGMENTS

The authors are greatly indebted to a host of people for their able aid and assistance. No extensive investigation of this type can be undertaken without the involvement of many individuals. We would especially like to acknowledge the contributions of Charles Brookfield, John Ogden, Charles Sindelar and Will Troyer. Pilots have spent many hours in arduous low-level flying and have played a large part in making it possible to gather data: Glenn Orton and Bill Snow from the Bureau of Sport Fisheries and Wildlife, Ralph Miele of the National Park Service and the late Fred Haag of the Lakeland Flying Service. We also gratefully acknowledge the assistance of Dave Anderson of the Bureau of Sport Fisheries and Wildlife in the computer analysis.

LITERATURE CITED

Broley, C. L.
1947. Migration and nesting of Florida bald eagles. Wilson Bulletin, 59:3-20.
1958. The plight of the American bald eagle. Audubon Magazine, 60:162-163, 171.
Herrick, F. H.
1924. Daily life of the American eagle: late phase. Auk, 41: 389-422, 517-541.
1932. Daily life of the American eagle: early phase. Auk, 49 (3 and 4): 307-323, 428-435.
1933. Daily life of the American eagle: early phase (concluded). Auk, 50:35-53.
1934. The American eagle. New York, D. Appleton-Century Co.
Howell, J. C.
1954. A history of some bald eagle nest sites in east-central Florida. Auk, 71:306-309.
1958. Further history of some bald eagle nest sites in east-central Florida. Auk, 75: 96-98.
1968. The 1966 status of 24 nest sites of the bald eagle. Auk, 85:680-681.
Howell, J. C. and G. M. Heinzmann.
1967. Comparison of nesting sites of bald eagles in central Florida from 1930 to 1965. Auk, 84:602-603.
Postupalsky, S.
1967. Reproductive success and population trends in the bald eagle in Michigan. Unpublished ms., Univ. of Michigan Biological Station.
Snedecor, G. W. and W. G. Cochran.
1967. Statistical methods, 6th ed. Iowa State Univ. Press.
Sprunt, A., IV and R. L. Cunningham.
1961. Continental bald eagle project. Progress Report No. I (mimeo).
1962. Continental bald eagle project. Progress Report No. II (mimeo).
Sprunt, A., IV and Frank J. Ligas.
1963. Continental bald eagle project. Progress Report No. III A Florida Notebook, Proceedings of the 59th convention, National Audubon Society, 2-7.
1966. Audubon bald eagle studies 1960-1966. Proceedings of 62nd convention, National Audubon Society.
Troyer, W. A. and R. J. Hensel.
1965. Nesting and productivity of bald eagles on the Kodiak National Wildlife Refuge, Alaska. Auk, 82:636-638.
Tyrrell, W. B.
1936. Report of eagle survey. Unpublished ms., National Audubon Society files.

DISCUSSION

MR. ERIC C. BOLEN: Another part of this equation is mortality. Those of us in Texas who are concerned about eagles are witnessing two bills in the Texas Legislature for consideration, one of which is curiously worded to permit the

shooting of varmints, including animals and birds, from airplanes. They assure us that this means only coyotes. However, let me assure you that a man in an airplane with a shotgun is an eagle killer.

Another bill that the Texas Legislature is interested in has to do with the electrocution of birds from high-line wires, particularly in Texas, where the bald eagles winter and pass through. There are at least twenty to thirty of these birds killed each winter by high-line wires.

Therefore, it is important, that we consider modification of these structures, and consider this aspect also.

REMARKS OF THE DISCUSSION LEADER

LEE M. TALBOT

Our Chairman has arranged a spectrum of papers on the subject of rare and endangered species that ranges all the way from presentation of the basic principles of endangerment and what you do about it to the specific problems, methodologies of how you deal with endangerment under a variety of conditions; again, ranging from this country and this society and economy to a series of different developing nations.

We have also been given pictures of several different approaches to conservation. They might be characterized as traditional or pure preservation versus the nontraditional economic-exploitation approach. However, if we look at it closely, we see quite a spectrum here.

The basic principles, of course, are that we have, with endangerment, two main factors. One is habitat destruction and the other is exploitation and, for the most part, these two are interrelated. There is no way, really, to separate them effectively.

Consequently, research and action must take a coalistic approach rather than a fragmented one.

In the developing countries, most of the problem is the availability of expertise and facilities and, beyond that, the location of this expertise within the government hierarchy. Therefore, in governmental priorities, conservation of endangered species, for the most part, in many countries of the world has simply not rated a high enough priority to receive the attention of government and get the maximum use and support except from the relatively few people who are concerned.

It was clear that laws are not enough; that international assistance in several ways is critically important, both through building awareness of the problem and assisting with the implementation. However, as was discussed just prior to the last paper, this assistance and implementation is a very delicate business and must be ap-

proached with a great deal of care to build on the support which exists within the country.

Basically, there are two levels of concern for an endangered species and, therefore, two basic motives for their conservation.

One of these is the direct, economic exploitation and this can be a pretty effective mechanism, and not only in developing countries. As a matter of fact, we have a number of examples of this. For example, in the USSR, a number of species, such as the sable, beaver and antelope, were brought back from what was considered to be close extinction, to very large numbers, almost solely because of their economic value.

However, the other value is in the nonconsumptive value to man. This implies a recognition, on the one end of the scale, of the tourist value of endangered species in, for example, national parks. Here perhaps you have a direct economic value but then it ranges to recognition of the recreational, aesthetic, and educational values, and then perhaps the value of the species to the ecosystem.

This, perhaps, is the most sophisticated part of the approach. We know now that every species plays a role and our Chairman emphasized this at the start. We don't really know what role most of them play. However, if one takes the analogy of an imaginary space ship, it would be rather foolhardy for a traveler on a space ship to throw out some of his life support equipment simply because he did not know what it was for and he wanted space for more comfort in his immediate occupation. However, this is essentially what we are doing when we exterminate species on earth before we know what role they play in the life-support system.

I mention this as a sophisticated approach and, therefore, one might think that this is the only approach of a few of the countries that have economic development and the scientific development to worry about this. However, I don't think that this is the case at all.

In the past, this was the cause and many of us still are thinking of the past when we tend to think there is an inescapable sort of economic ecological succession.

Within the past year or two, we have seen an almost instantaneous ecological succession of the concern and the sophistication with endangered species. In the past year alone, for example, we have seen this in relation to the Stockholm Conference where over a hundred nations agreed upon the values of wildlife and, most important, maintaining the role of that wildlife in the ecosystem.

We have seen, the development of the World Heritage Trust several months ago. We have seen the Marine Mammal Protection Act, in which the United States has the best definition of conservation yet to

appear in a national law anywhere, which ranges and covers the whole range from pure protection to maximum sustainable exploitation. Perhaps, more important, it has the first statement of national policy that is the objective of the conservation of wildlife.

We have also seen the agreement in relation to environmental protection—the first concrete results of the agreement being signed less than a year ago through the efforts of a wildlife working group meeting in Russia less than a month ago. Further, we have the proposal of 22 specific projects to be initiated this year between the United States and Russia, for the most part, dealing with conservation of endangered species of man and animal.

We have also seen the Convention on Trade in Endangered Species, which was likewise mentioned earlier today. This is an incredible international activity and concern, especially against what was available two or three years ago, much less twenty years ago.

Now, you may say that these are inter-governmental activities for the most part, that they do not have to do with what a nation is doing to its endangered species at home. Of course, this is true. However, I do think that they show that wildlife conservation has become socially acceptable and politically stylish for government.

This, in no way, insures the survival of endangered species but it does insure that efforts which we have been describing here have a vastly better chance of support by the governments, our own included, than they had before.

* * *

TECHNICAL SESSION

Tuesday Morning—March 20

Chairman: JUSTIN W. LEONARD
Professor, University of Michigan, Ann Arbor

Discussion Leader: T. R. SAMSELL
Director of Environmental Conservation, Continental Oil Company, Washington, D. C.

SEEKING IMPROVEMENTS FOR WILDLIFE AND FISH

REMARKS OF THE CHAIRMAN

JUSTIN W. LEONARD

Good morning ladies and gentlemen.

This is the technical session on the general topic "Seeking Improvements for Wildlife and Fish."

Assisting me as discussion leader is Mr. P. R. Samsell, Director of Environmental Conservation, Continental Oil Company, Washington, D.C.

He is a former wildlife biologist from West Virginia and was, for many years, chief of the research division and finally, director of the West Virginia Department of Natural Resources, before taking his present position with industry.

This morning's session, as you will see, is divided into halves, the first dealing with "Strip Mining, Resources in Conflict" and the second comprising a special presentation on the new North American Wildlife Policy.

After the conclusion of the strip-mining session, our panelists will leave the podium and then, in turn, I will be joined here by Professor Durward Allen, who will present the North American Wildlife Policy.

Now, to acquaint you with the subject directly and to also acquaint

[1] In the absence of the author, this paper was presented by Dr. Robert Bay.

you with the world's supply of stored solar energy, which is the basis of our life here on earth, we have been able to put together a very competent panel to discuss the problem of how to extract needed energy sources and other resources from the earth and, at the same time, conserve many of the other attributes of the environment which are seen to be increasingly valued.

The panel on strip mining has been put together with people who not only have competence but whose experience is such as to qualify them to talk on the major aspects of this admittedly controversial subject.

It is obvious that on a topic of this kind, if we start discussion of each paper, the result will be to anticipate much of the presentation in the papers to follow and so I believe we will try to move the papers through in sufficient time to allow for informed discussion on the basis of the total presentation.

The first paper will be entitled "Impact and Restoration Efforts in the West." Your program indicates that it was to have been presented by Dr. Otis Copeland. Regrettably, a serious illness in his family kept him at home. However, we are fortunate to have this material presented to us by Dr. Robert Bay, who is Chief of the Watershed and Aquatic Habitat Research for the U.S. Forest Service and who has been concerned nationwide with wetlands programs ever since he took his PhD degree from the University of Minnesota in wetlands ecology.

At this point it is my pleasure to present Dr. Robert Bay.

* * *

PANEL
Strip Mining: Resources in Conflict

MINING IMPACTS AND RESOURCE MANAGEMENT[1]

OTIS L. COPELAND
USDA Forest Service, Intermountain Forest and Range Experiment Station, Ogden, Utah

INTRODUCTION

More than 100 years ago, the historic Gold Rush aided the opening of the West; today, the widely heralded Energy Crisis is serving a similar role in the rediscovery of the Interior West, where fuel and mineral resources still abound in relatively untapped deposits (Fig. 1). However, this rediscovery poses some grave environmental concerns—concerns that are causing alarm to the public in some quarters.

The magnitude of the mining activity that can be projected to tap these resources if the Energy Crisis so dictates is enormous. The potential for both shortrun as well as lasting degradation to the forested and grass-covered lands of the Interior West probably is greater from unregulated facets of mining operations than it is from all the existing authorized uses of these lands (Fig. 2).

Strip mining of minerals—and of fossil fuels particularly—already is expanding rapidly. Some 90 minerals, including coal, oil shale, uranium, phosphate, and various building materials (gypsum, sand, limestone, etc.), are found in sufficiently large deposits to make them economically minable. In all areas, development could substantially disturb the surface environment (Copeland and Packer 1972).

MINERAL RESOURCES OF THE INTERIOR WEST

Coalfields in Montana, Wyoming, North Dakota, South Dakota, Utah, Colorado, New Mexico, and Arizona underlie more than 100 million acres and contain more than 2 trillion tons of coal. Approximately 100 billion tons are considered commercially strippable by present technology. Strippable coal is regarded as that found in seams at least 6 feet thick and overlain by overburden not exceeding 150 feet in depth (Blumer, Dahl, and Matson 1969). These criteria are based largely on economic considerations and are subject to change. Although western coal is relatively high in ash content and relatively low in BTU's, its sulfur content usually is only about one-tenth to one-fifth that of eastern coal. Therefore, combustion sulfur emissions are low and acid mine drainage problems are rare.

[1] In the absence of the author, this paper was presented by Dr. Robert Bay.

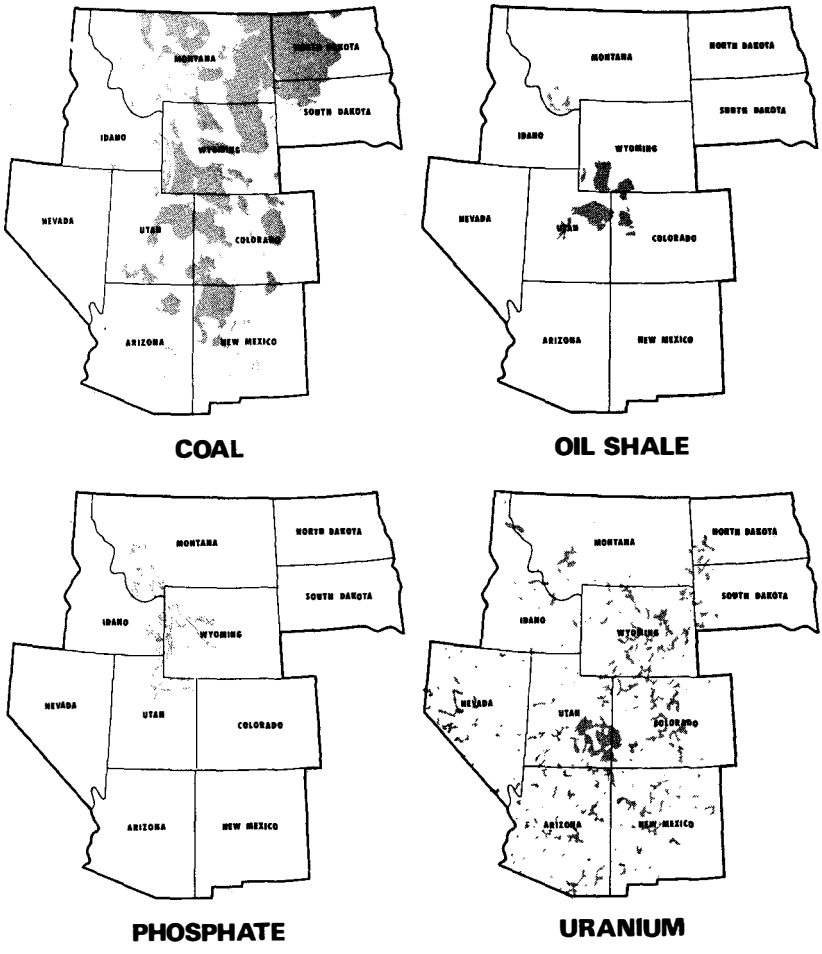


Figure 1.—Geographic occurrence of four important minerals susceptible to surface mining in the Interior West.

A major undeveloped energy source is oil shale. The richest deposits occur in the Green River formation, which comprises 2,600 square miles in Colorado, 4,700 square miles in Utah, and 9,200 square miles in Wyoming. In this formation, the potential oil yield ranges from 10 to 25 gallons per ton; thus, hundreds of billion barrels of oil lie in reserve awaiting extraction.

Uranium deposits are widely scattered throughout the plateaus, basins, and mountains of the Interior West. Major sedimentary deposits are found throughout the Colorado Plateau, covering about

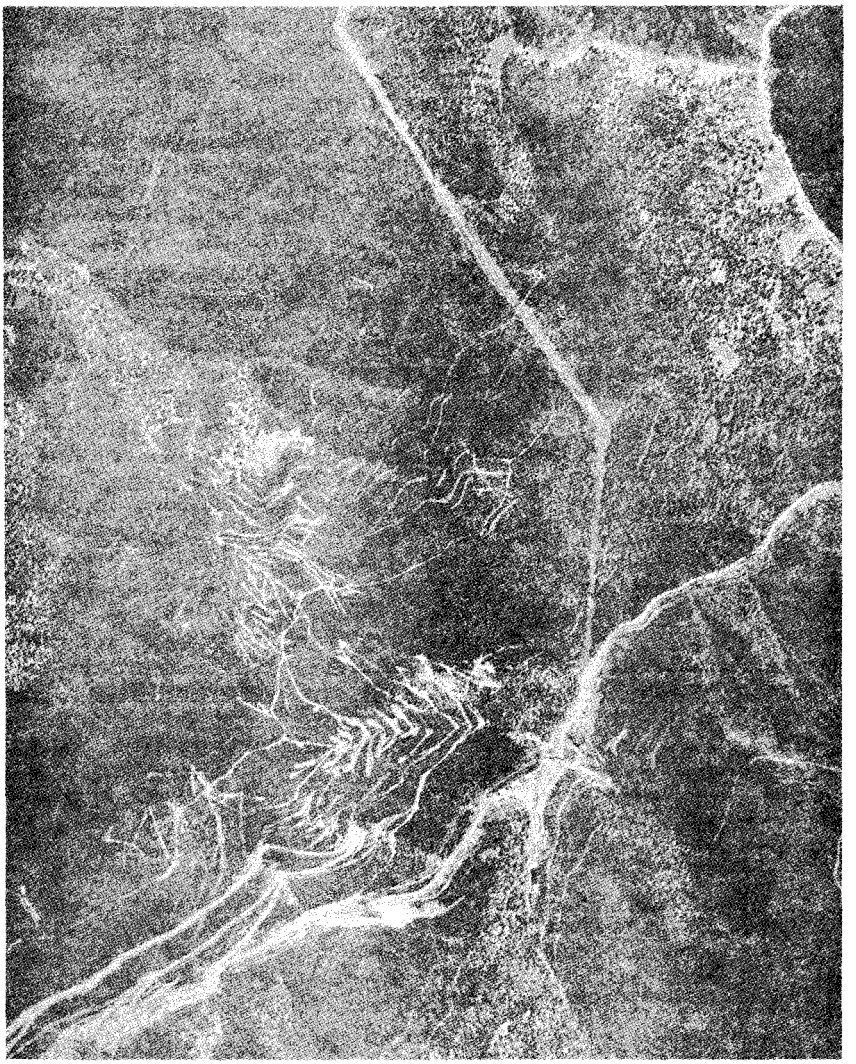


Figure 2.—Roads, trails, and exploration trenches resulting from mining activities on one small portion of the Salmon National Forest, Idaho. Approximately 300 miles of such disturbance occur on this Forest.

150,000 square miles in portions of Colorado, Utah, Arizona, and New Mexico. Both underground and surface mining operations are used. The anticipated advent and expansion of nuclear power generators in the future are expected to increase the demand for uranium some 20 to 25 times by year 2000 (USDI 1970).

The western phosphate field, centered in southeastern Idaho and contiguous areas in Utah, Wyoming, and Montana, contains the largest known deposits of phosphate rock in the United States, accounting for 42 percent of our known national reserves. Phosphate deposits of commercial value are spread over approximately 10 million acres, but the entire field has not yet been fully explored. Unfortunately, these deposits are not optimally located with respect to heavy fertilizer-consuming areas or major transportation systems, including seaports.

Valuable metallic deposits of copper, lead, cobalt, zinc, molybdenum, gold, nickel, iron, and silver are found throughout the Interior West. Numerous deposits of other valuable nonmetallic minerals abound. These include gypsum, clays, vermiculite, pearlite, talc, flagstone, fluorspar, limestone, sand, and gravel.

POTENTIAL DEVELOPMENTS

I do not contend that all fuels and minerals susceptible to mining in the Interior West will be surface mined or otherwise extracted—now or ever; however, the potential for surface environment disturbance staggers the imagination. For example, a 30-percent increase in tonnage produced by surface mining has occurred in the Interior West in the past 7 years. In 1969, coal production in Montana was 1 million tons; this year production is expected to increase to 17 million tons, and perhaps to 200 million tons annually by the 1980's (Schneider 1973).

Within the next 20 years, local electric energy demands in the Interior West are expected to quadruple and local demands for coal are expected to skyrocket 512 percent (Scott 1971). In addition to local consumption, coal is being shipped to Chicago, Minneapolis, Kansas City, Texas, and Tennessee. Shipments of low-sulfur coal to areas other than these are expected to be made in the near future.

To satisfy the requirement of reducing air pollution in the Midwest and Pacific Coast metropolitan areas, generating plants are now being developed near mines in sparsely populated areas of the Interior West. The electricity generated by these mine-mouth plants is being shipped to consuming centers via a conspicuous grid of high voltage transmission lines. The Four Corners plant is the largest coal-burning facility in the United States. It consumes 25,000 tons of coal daily, and generates more than 2 million kilowatts of electricity. It is the subject of much controversy because it emits hundreds of tons of particulate and gaseous pollutant daily. (Wolff 1972). At least five other generating plants are under construction or are being planned in the southwest region. The planned development of the Kaiparowits

power plant in extreme southern Utah would require a work force of several thousand, which would likely create a new city of 17,000 people, or about seven times the present population of agrarian Kane County in which it is planned, according to the report of the Southwest Energy Study (USDI 1972).

The North Central Power Study (North Central Power Study Coordinating Committee, 1971) has identified 42 suitable coal mine-mouth generating sites in that area, of which 21 are in eastern Montana alone. The number that might be actually developed will be determined largely by the availability of water and resistance by the public or environmental groups. Full development of the 21 mine-mouth plants and associated operations in Montana would require major water developments and might increase the population of eastern Montana by 300,000.

Similar estimates of the population increase attributed to projected coal developments in Wyoming range up to 150,000 people.

By 1973, coal production in Montana is expected to reach 17 million tons; this will cause complete disturbance of between 275 and 520 acres of land annually. Full development of presently known strippable coalfields in Montana would overturn 770,000 acres (Gill 1972). The extent and rate of coal developments in the Dakotas, Wyoming, Utah, Colorado, New Mexico, and Arizona are unpredictable; but the magnitude and effects are likely to be proportional to those expected in Montana. Although much of the topography of these coalfields is usually flatter than Appalachian coalfields, the aridity and harshness of sites make them far more difficult to revegetate.

Development of the oil shale industry may well hinge on the availability of adequate water supplies, not only for the mining and extraction activities but for the associated industries, services, and people. The disposition and stabilization of retorted shale pose problems because of the voluminous heat-treated residues, harsh climate, and inhospitable soil conditions. It is estimated that water requirements for operating a million-barrel-per-day shale oil industry would range from 60,000 to 95,000 acre feet per year, excluding any other minerals processing (USDI 1970). This is equivalent to annual per capita water requirements of 350,000 to 565,000 people.

As a fertilizer element, phosphorus has no substitute. This use accounts for 76 percent of the current national production. Production estimates projected to the year 2000 indicate a possible threefold increase over current production, which is 6 million tons annually. Because of a favorable cost-production ratio, surface mining is certain to continue in the western phosphate field development. Already, about 30,000 acres of the Caribou National Forest in Idaho are under

active phosphate leases, and resource management on two districts has been adversely affected.

COMPLEXITIES IN RESOURCE MANAGEMENT

Most of the lands underlain by fuels and minerals in the Interior West are in federal ownership administered by such agencies as the Forest Service, Bureau of Land Management, and Bureau of Indian Affairs. A considerable acreage is state-owned; the remainder is in private ownership. Ownership of these lands is often complexly intermingled. One example of complex ownership is the 900,000-acre Decker-Birney area in southeast Montana. Sixty-nine percent of the land surface is privately owned, 17 percent is administered by the Forest Service, 9 percent by the Bureau of Land Management, and 5 percent by the State of Montana. However, mineral rights are retained in an approximate reverse manner: 7 percent privately owned, 5 percent by the State, and 88 percent by the Federal Government. Statewide, more than 55 percent of strippable coal deposits in Montana is in public ownership.

A plethora of federal, state, and local laws pertaining to various facets of the composite mining operation presents a maze of confusion and a jungle of jargon with respect to mineral entry, location, patenting, leasing, developmental operations, royalties, and subsequent rehabilitation. Only 28 states have mining rehabilitation laws; these vary widely as to stringency and enforcement. A revised mining law, still in draft stage, is now being considered by the current legislative session in Montana. Reputedly, this could become the toughest strip mining bill in the Nation. Mining laws containing rehabilitation provisions have not yet been passed in Utah and New Mexico, two States that figure prominently in mining activities. However, such legislation is now pending in these two States.

As of June 1970, in the Interior West, there were 94,402 mineral leases covering 58,905,110 acres on public and acquired federal lands; this exceeds the combined area of New Jersey, New York, Rhode Island, Massachusetts, Vermont, Connecticut, and New Hampshire. No information is available as to the number of leases on privately-owned lands. More than 800,000 mining claims exist on national forest lands alone. Currently, new mineral locations are being filed on the national forests at a rate exceeding 10,000 per year. Potential mineral claims could encompass as much as one-third of the national forest lands of the Interior West.

Little quantitative information exists on the impacts of mining on fish and wildlife populations and their respective habitats. Studies and observations show that highly acid waters from cobalt, copper,

and sulfur mines kill fish and destroy fish habitats. Other examples show that sediment resulting from mining totally destroyed stream channels that were formerly stable. In Idaho, exploratory mining roads have damaged feeding areas on winter ranges of mountain goats. Development of active claims could cause the loss of considerable winter range already in short supply. In much of the coal mining area of Montana, natural vegetation communities are extremely slow in reestablishing themselves on abandoned spoil; hence, wildlife populations that are dependent on such vegetation cannot be expected to thrive. Restoration of suitable wildlife habitat must be based upon definitive plant ecology-environmental studies.[2]

Impingements on the environment take numerous forms. Visual quality is deteriorated by indiscriminate surface disturbance activities. Of more than 690 surface-mine sites examined by the Strip and Surface Mine Study Policy Committee (Detwyler 1967), nearly 60 percent were observable from public use areas. Their unsightliness related directly to the discordant image presented when compared to surrounding landscapes. Customarily, as surface soil and overburden are removed, they are buried beneath the inert and nonproductive submantle materials. Row upon row and pile upon pile of inhospitable acid or alkaline rocky debris are either left without any protection—to erode and produce sediment—or else leveled and left as an unsuitable site for natural revegetation. The precious thin layer of surface soil must be accorded rightful preservation if successful reclamation is to be achieved.

Social, cultural, and economic "fallout" may be great. Many small communities, steeped in rural heritage and bound by strong social customs—particularly those agrarian in nature—stand to face a shattering experience from the influx of such a radical innovation as a booming mining industry. When the nonrenewable resources are extracted, what becomes of the boomtowns?

When we take cognizance of the present situation, we had better forsake ideology for reality. We must recognize the finiteness of our resources; and, as environmental-conscious citizens and agencies, unite in concerted effort for a national "prudent resource ethic." What we need nationwide is a means of meshing and harmonizing the development and utilization of fuel and mineral resources with the values of associated resources and vice versa. Extractive procedures must be kept compatible with residual values. At the outset, mining developments must be targeted toward preserving or restoring an acceptable environment.

[2] James A. Posewitz, Montana Fish and Game Department. Personal communication, January 2, 1973.

Coordinated effort in preplanning and programing the full sequence of mining operations in relation to other resource management is vital and is just now beginning to gain momentum. Meaningful attention has been given to land rehabilitation only in recent years. Although marked success has been achieved in devising rehabilitation treatments for mined lands in the eastern United States, far less effort and success has been experienced in the West. It would be foolhardy to attempt universal application of treatments used in the East because the most striking characteristic of the Interior West is diversity—extremes in climate, geology, soils, elevation, and vegetation. Likewise, it is equally untenable to expect that all disturbed areas can be returned to verdant landscapes. Some sites never were—some never will be. But optimum reclamation preplanning is mandatory; it must be in keeping with (a) climatic constraints, (b) visual quality acceptability, and (c) optimum land productivity capability.

A POTENTIAL SOLUTION

An excellent opportunity exists for a coordinated program involving federal, state, and private research organizations, industry, universities, and land-management agencies to ameliorate the impacts of surface mining on the environment. Such a program, planned by the Forest Service and approved by the U.S. Department of Agriculture, is known as SEAM.

SEAM, an acronym for "Surface Environment and Mining, " is a research, development, and applications program to help meet the nation's Energy Crisis and produce needed minerals in harmony with a quality environment and other natural resource values. The ultimate objective is to provide land managers, the mining industry, and the states with an innovative array of economical planning, developmental, and reclamation alternatives that satisfy both environmental and mineral needs. Initial effort will be concentrated in those portions of the West where large-scale mining operations are already underway or are being planned. The planning unit will be headquartered at Billings, Montana.

To be successful, SEAM must be managed as a partnership endeavor; participants will include land managers, the public, the mining industry, universities, and political jurisdictions. SEAM will be closely coordinated with ongoing federal and state programs, such as the interagency Northern Great Plains Resources program. The end product of SEAM will be development of large-scale demonstration areas where new methods for land rehabilitation, new mining technol-

ogies, and improved environmental stewardship criteria can be simultaneously displayed and evaluated.

SEAM has six goals: each has subgoals that require specific actions.

Goal No. 1. Develop organizational, legal, physical, and economic criteria for use by land managers in administering mineralized lands.

Subgoals. Improve means of coordinating federal, state, local, and industry authorities and responsibilities. Develop criteria for determining the impact of mining on other resources, uses, and activities.

Goal No. 2. Develop alternative land rehabilitation treatments to enhance or return disturbed areas to beneficial use.

Subgoals. Conduct physical and biological inventories. Plan mining activities with concomitant reclamation activities. Develop plant selection, seedbed preparation, seedling-care techniques, and establish plant nutrition requirements.

Goal No. 3. Develop alternative engineering systems to prevent or reduce future environmental damage.

Subgoals. Develop or improve systematic approaches for prospecting and exploration. Examine, develop, and test innovative transportation systems. Test alternative methods of earth movement and placement, including costs and benefits. Determine the most economic environmentally acceptable surface treatments.

Goal No. 4. Evaluate the influence of mining developments on surrounding rural areas and determine options for rural area development.

Subgoals. Design and conduct mining to maintain visual landscape quality. Devise plans to ameliorate the impact of mining developments on local communities. Plan for community stability following cessation of mining.

Goal No. 5. Synthesize, test, monitor and evaluate systems and practices on demonstration areas to identify alternatives, cost, benefits, and environmental consequences of mineral utilization.

Subgoals. Develop or adapt analytical techniques for modeling potential systems. Establish and manage demonstrations under a variety of conditions and constraints. Evaluate alternative systems.

Goal No. 6. Provide land managers, industry, and regulatory outhorities with skills and recommendations needed to apply findings to future area developments.

These goals relate to the proper husbandry of surface environmental values concomitant with utilization of minerals and energy sources. Both are vital to the continued growth and prosperity of this

country. Neither can be executed in a vacuum—they must be made compatible through farsighted planning and coordinated development as envisioned by SEAM.

Already, the Forest Service has launched a very modest program of rehabilitation studies with the cooperation and assistance of four large, progressive mining companies. Fullscale implementation and ultimate success of program SEAM rest upon manifestation of genuine concern for environmental protection of the rediscovered Interior West. This support must come from all segments of the American public.

LITERATURE CITED

Blumer, J. W., G. Dahl, and R. Matson.
1969. Strippable coal deposits on state land, Powder River County, Montana. Mont. Bur. Mines Geol. Bull. 69.

Copeland, Otis L., and Paul E. Packer.
1972. Land use aspects of the energy crisis and western mining. J. For. 70(11):671-675.

Detwyler, Thomas R.
1967. Man's impact on environment. New York: McGraw-Hill Book Co., p. 357.

Gill, Thomas J.
1972. Coal development potential in eastern Montana. State of Mont. Environmental Quality Counc. Rep. 19 p.

North Central Power Study Coordinatnig Committee.
1971. Study of mine-mouth thermal power plants with extra-high-voltage transmission for delivery of power to load centers. Vol. 1. (Prepared for the Bur. Reclam., Billings, Mont.)

Schneider, Bill.
1973. Montana—the big sacrifice. Mont. Outdoors 4(1):12-19.

Scott, James J.
1971. Factors influencing the growth of surface coal mining in the western states. (Paper presented at SME meet., Seattle, Wash., Sept. 22-24.) Preprint 71-F-341.

U.S. Department of Interior.
1970. Mineral facts and problems. Bur. Mines Bull. 650, 1291 p.

U.S. Department of Interior.
1972. Southwest energy study—an evaluation of coal-fired electric power generation in the Southwest. Prepared by Study Manage. Team.

Wolff, Anthony.
1972. Showdown at Four Corners. Saturday Rev. of the Soc., June 3:29-41.

STRIP MINING: RESOURCES IN CONFLICT: IMPACTS AND RECLAMATION EFFORTS IN ILLINOIS

W. D. KLIMSTRA AND S. R. JEWELL
Cooperative Wildlife Research Laboratory, Southern Illinois University at Carbondale, Illinois

The commercial surface mining for coal in this country began near Danville, Illinois, in 1866 (Anon. 1972). Today, coal production in Illinois by surface mining has reached 30 million tons per annum, which is approximately 50 percent of the state's total coal production. Illinois, although the initiator of commercial surface mining, was the last of the six states, producing 85 percent of the surface-mined coal, to enact legislation pertaining to surface-mined land reclamation (Weber 1962). For these reasons and Illinois' long history of surface-mined land research and large total reserves, it is relevant that we observe (1) the impact of surface mining in Illinois; (2) the interaction of research, legislation, and reclamation practices, which have modified the affected environment; and (3) the resulting condition and utilization of the affected land. Our presentation will concentrate on surface mining for coal because land affected by extraction of other minerals is relatively minor when surface area is considered.

The total extractable bituminous coal reserves of Illinois have most recently been estimated at 140 billion tons; these are the largest known reserves in any of the United States (Simon and Smith 1968). Coal deposits are formed in a bowl underlying 66 percent of the state (36,806 square miles). Strippable coal reserves (those reserves in seams $\geq$18 inches thick lying $\leq$150 feet below ground surface), available largely in the periphery of the deposit, are estimated at 19 billion tons and underly 2.3 million acres of land (Smith and Agaste 1966).

RESUME OF LEGISLATION AND RESEARCH

In Illinois, effective reclamation legislation was slow to be enacted. After the first regulatory bill was introduced and defeated in 1929, 30 other regulatory bills were introduced in 13 of the next 16 biennial legislative sessions (Weber 1962). All except two were defeated in committee, in the assembly, or by gubernatorial veto. One of the two bills that passed was an investigative bill in 1941 and the other was a regulatory bill in 1943, stemming from the investigation; but, it contained more stringent reclamation requirements than the investigators had recommended. However, the latter was found unconstitutional in 1947 as the court decisioned that a land owner could not be required, at his own expense, to redeem his land to a ". . . higher and

better use. . . ." But, other court cases at the county level developed concerning zoning against surface mining in Knox County, in a prime agricultural area of the state. Thus, after 22 years of defeat, a modification of Indiana's law, to fit Illinois conditions, was enacted as the Open Cut Land Reclamation Act, to be effective on January 1, 1962. The law was developed cooperatively by industry, a farm organization, a sportsman's group, and legislators. The basic components of this law were establishment of permits, permit fees, and bonds on land with greater than 10 feet of overburden above the mineral to be extracted. Minimal grading and revegetation were required, although acid-forming materials in an exposed highwall were required to be covered with 2 feet of spoil material or water. One-half year after surface mining, a reclamation plan for the affected area was to be submitted indicating for what purpose the land was to be reclaimed. Extent of reclamation depended on the post-reclamation use. However, "problem areas" were given a 10-year exception after which they were to be released, acceptably reclaimed or not, without forfeiture of bond. Also, land in need of reclamation and mined previous to the law could be substituted for land mined under the law for reclamation. Administration of regulations was assigned to the Division of Land Reclamation, to be created in the Illinois Department of Conservation.

After enactment of the Open Cut Land Reclamation Act, industry's input in development of further reclamation legislation lessened, whereas local government's influence increased. In the middle 1960's a Governor's Commission, composed of six legislators, two educators, and one representative from the Mid-West Coal Producers Institute, Inc., was established to evaluate the current law by on-site visitations and by conducting public hearings. The product, The Surface-Mined Land Reclamation Act, an amendment, effective July 1, 1968, was more restrictive than the previous bill. The new law required some grading of all affected land; established density standards for revegetation of both ground, woody and herbaceous plants and trees; but, it still allowed exceptions for reclamation of problem areas but provided for bond forfeiture and substitutions for reclamation of other unreclaimed lands for lands mined under the law (Anon. 1968).

The 1968 law did not appease several interest groups, including legislators who sought successfully to enact a more restrictive law. The Surface-Mined Land Conservation and Reclamation Act of 1971 was developed and passed without the advice of industry or other governmental and private expertise familiar with Illinois surface mining and reclamation problems. Under this law (Filer 1972), the unreclaimed land substitution clause was deleted; permits were

required also for land with greater than 10 acres affected per permit year; permit fees and bonds were increased; land was required to be graded within 1 year after mining to 15 percent or original contour with 30 percent exception; revegetation was to be accomplished in 3 years; and, standards were increased. Two additional and important requirements were (1) that a map of the area to be affected was to be submitted with the permit application along with a detailed description of the area including ownership, composition of the vegetation and wildlife, current and past land uses, geological features and a reclamation plan; and, (2) that the pertinent county board was to review and comment on all plans prior to submission of the permit application to the Division of Land Reclamation.

Research on surface-mined lands of Illinois has resulted from scientific concern, private interest, and legislative action. Investigations have been continuous since the early 1900's, when McDougall (1918, 1925) and Croxton (1928) examined natural revegetation of Illinois spoils. Since 1947 the University of Illinois has studied various agronomic land uses (Grandt 1952, Grandt and Lang 1958). Representatives of the U.S. Forest Service (Deitschman 1950, Limstrom and Deitschman 1951) evaluated several species of trees under various conditions to determine their potential for satisfactory growth on surface-mined land. Wildlife and its management received the attention of the Illinois Natural History Survey in the late 1930's (Yeager 1940, 1942). This subject was later more extensively evaluated by several other researchers (Riley 1954, 1957; Klimstra 1959; Verts 1956, 1957, 1959; Birkenholz 1958; Arata 1959; Myers and Klimstra 1963; Brewer 1958; Vohs and Birkenholz 1962).

In the early 1960's Southern Illinois University, in cooperation with the Illinois Department of Conservation and Mid-West Coal Producers Institute, Inc., determined the availability and suitability of surface-mined areas for potential public-owned recreation areas (Roseberry 1963). In satisfying administrative needs at the time, this study was one of the most meaningful general surveys. However, research was needed on spoil material conditions as related to geological region, mining technique, and weathering of spoils after mining. Roseberry and Klimstra (no date) compared ecological succession on spoils formed by wheel excavators versus shovels. McGrath (1972) examined soil parameters of acid spoilbanks in southern Illinois, relating them to mining technique and age of spoils, finding that aging and weathering modified toxic conditions. These efforts culminated in an extensive and intensive survey of ownership, conditions, and land use of Illinois lands affected by surface mining for coal (Haynes 1972). Although not fully quantified, the use of

sludge, municipal sanitary waste, in reclaiming the surface of acid spoils has been studied in southern Illinois (Lejcher 1971).

IMPACT OF LEGISLATION

During the years of the first law, a significant portion of industry viewed regulations as a nuisance to be tolerated. Generally, restoration of land to productive use was not accepted as a responsibility to be incorporated with mining. Apparently, there were few administrative directives to mining operations to accommodate reclamation. With the revision of the law in 1968 there was little change in attitude of companies until affected lands were subject to review for bond release 3 years later. Many acres failed inspection; hence, industry has only recently experienced the significant impact of the 1968 revision (E. E. Filer personal communication 1973). This has resulted in a fuller appreciation of responsibility for reclamation. There has been a rapid move toward accommodating such needs as evidenced by reorganization, planning, budgeting and personnel assignments. This will surely enhance more successful implementation and responsible accommodation of the restrictive new law of 1971.

As a result of the 10 years of regulations, there has been a decline in the number of companies, particularly the small operations. Generally, most of these were in financial trouble; hence, reclamation requirements, although contributing to their financial problem, probably did not directly reduce their numbers. Although consolidation of interests by some large companies has occurred, it is not to be assumed that this reflects increased reclamation costs. Significant is the fact that the number of permits issued has declined 43 percent and the number of mines 20 percent between the first half and the second half of the last decade, whereas permit acres have increased.

Historically, several companies have voluntarily assumed some responsibility for restoring disturbed acres to productive uses. Such is evidenced by not only reclaimed acreages of pre-law lands but also the employment of land managers who were charged with such activities. It is evident, too, that a given company did not exhibit uniform effort in reclamation at all mine sites. This seems related to the impact of local public pressures; but, in some cases, this may have been more a result of a given mine superintendent's attitude as well as, in some cases, the quality of the spoil banks.

THE AFFECTED ACREAGES

Through 1971, in excess of 17 percent of the strippable coal reserves have been mined affecting around 166,000 acres (Smith and Agaste 1966, Averitt 1968, Filer 1972). In comparison, acreages

under permit affected by surface mining for limestone, shale and clay, silica, and sand and gravel were 2,158, 177, 97, and 50 acres, respectively, during the same period. The present rate of mining for coal is affecting approximately 7,000 acres per annum. This represents an increase of nearly 40 percent since 1962. That surface mining is an environmental issue in Illinois is reflected in the fact that potentially 7 percent of the land surface may be disturbed. But, more important, up to 61 percent of some counties may be subjected to surface mining (Smith and Agaste 1966).

For a general picture of surface-mined land the information has been arranged according to current management regions of the Illinois Division of Land Reclamation. Region I contains highly fertile silt soil, with consequent prime agriculture (Figure 1). Region II is proximate to large urban areas, reflects problem spoils and some acidity, has acceptable water associated with affected land, and is extensively used for recreation. Region III has been subjected to only limited mining and shows much variability in soil conditions. Regions IV and V show considerable acidity, rockiness, and clay type soils; but, handled properly, they are suitable for reforestation and pasture development. Total stripped acreage per region ranges from approximately 68,000 acres in Region I to 8,000 acres in Region III, with Regions V, IV, and III having 43,000, 24,000, and 18,000 acres, respectively.

If pH of spoilbanks is a function of the consolidated overburden matrix, mining and reclamation techniques, and revegetation, one might assume that generally post-law spoils, although in earlier stages of revegetation, would show a more neutral pH. However, the relative percentages of land in three pH classes are comparable between pre- and post-law, indicating that, generally, spoilbank pH may be more a reflection of the natural characteristics of the unconsolidated overburden. Approximately 3 percent of the total acreages of spoils show a pH of 4.0 or less, the level of critical toxicity for most vegetation. Of the 14,000 acres of water, around 7-8 percent reflect a pH of 6.0 or less. These acreages are located largely in Regions II, IV, and V.

The response to legislative requirements is more evident in the trends of physical manipulation of spoilbanks than elsewhere with respect to condition. As was expected, pre-law grading was much less prevalent than when subjected to requirements of the first two laws. In Region I, where there is heavy emphasis on agricultural use, 59 percent of pre-law land was graded as compared to 37 percent in Region V. Region V and Region I show 89 and 80 percent, respectively, of post-law affected land graded; however, grading was more

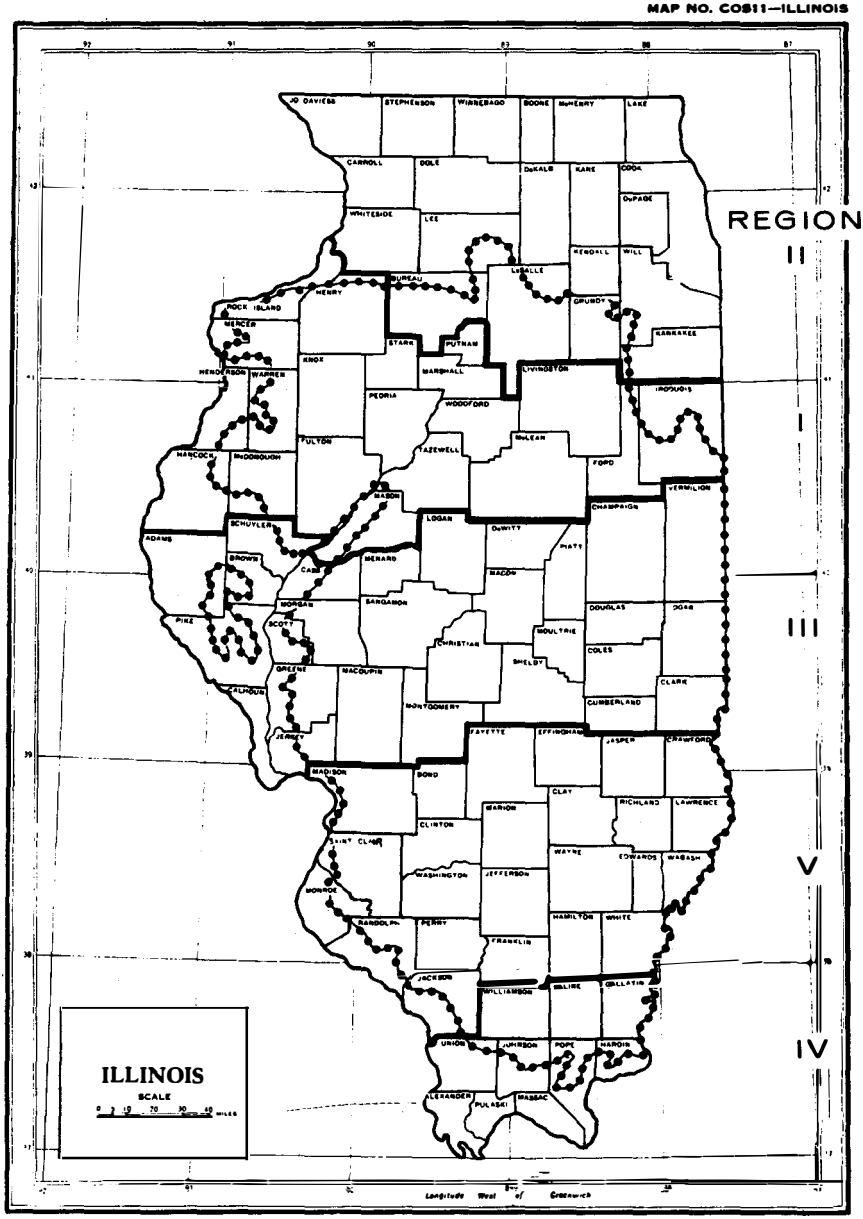


Figure 1.—Coal reserves (•–•–•) and surface-mined land management regions (———) in Illinois, 1972.

intensive in Region I than in Region V. Seventy-four percent of all post-law land was graded versus only 39 percent of pre-law land.

Ownership of pre-law land has changed considerably during the decade of reclamation regulations. Coal company ownership has decreased 33 percent with an accompanying increase in other ownership groups. Although coal companies continue as the principal owners of pre-law lands, recreation organizations and private or family groups own more land in some regions than does industry. Due to the relatively short time since mining of most post-law lands and for meeting reclamation requirements on these, industry holds title to most of these lands.

Of the total acres affected by surface mining, nearly 60 percent has been considered to reflect various degrees and types of reclamation (Filer 1972). Apparently, 28, 11, 8, and 8 percent of pre-law acreages were reclaimed for pasture and other crops, forests, recreation and industry or in water, respectively (Filer 1972). Forty-five percent of the land was not reclaimed. Based on preliminary analysis of survey data, observed utilization of the affected acreage, 32 percent is in agriculture, 24 percent (including 7 percent water) in recreation, 36 percent is non-utilized (including 1 percent water and 20 percent forests) and 8 percent is in other utilization (Haynes and Jewell 1973). Implied here is that reclamation effort should not be construed as synonymous with utilization. Further, it is of significance that the survey revealed that about 10,000 acres had less than a 26 percent ground cover; and, also, there were over 5,200 acres affected by gob and slurry.

Post-law lands (those affected since 1961) of approximately 60,000 acres show 89 percent reclaimed for cropland, 7 percent for forest, and 4 percent for recreation and other uses. However, when comparison is made with results of the recently completed survey, observed utilization showed 27 percent cropland, 3 percent recreation, 5 percent other utilization and 65 percent (3 percent forest) non-utilization. Important here, of course, is time as more than 3 years of these acreages ($>$20,000 acres) are not subject to approval for bond release. Also, there has not been adequate time for acreages recently approved to have been placed into use; and, recreational attraction is limited, either due to the time for good vegetational cover to become established, or the proximity of active mining.

Recently, there has been an obvious trend to emphasize the return of these acreages to agricultural uses. Significant is the fact that, in 1971, approved reclamation reflected 98 percent cropland, largely legumes and grasses. The survey showed over 940 acres of gob and slurry on post-law mined land.

Almost everywhere the public exhibits great interest in multiple-use or single-purpose recreational use of surface-mined areas. Especially is this true if there is water. But, virtually none of this has been planned through reclamation activities by companies either now or in the past. And, current trends of reclamation show little effort to contribute recreation lands. This is due, in part, to somewhat greater restriction for a company to go this route; but, also, recreation interests generally do not represent adequate and profitable buyers so as to attract industry. Further, companies are not geared to the recreation business; they do not look with favor on having to manage people while operating a mine; there is the question of liability; and, they must remember the public abuse of surface-mined areas, *i.e.* dumping garbage and illegal entry.

There is much variation in the state as to patterns of use as related to the type of reclamation. In some counties and regions there is near complete use of pasture; whereas, others show little or no harvest of grass and legume crops. It is postulated that the type and extent of reclamation and the degree of use probably exhibit, to a large extent, the public attitude, hence pressure, that has been experienced by the surface-mining industry. Therefore, where naturally productive farmland has been disturbed, pre-mining land use and associated life styles are reflected in decision making. For example, in west central Illinois, there has been exercised the maximum degree of grading for several years because of the high quality surface soils and related agricultural interests. Northern Illinois reveals the public interest demand for recreational space as a result of the vicinity of high density human populations. Southern Illinois exhibits the natural low quality of surface soils, the extensive acres of idle land, and the conditional attitudes of people who have depended on the coal economy for so many years.

GENERAL COMMENTS

Productive use is a necessary objective of reclamation; but, in what terms and in what period of time? Can it be pasture and no cows; recreation and no users; or, trees and no forest management? Should productive use be based solely on its level of contribution through real estate taxes? Although productivity is an integral part of our society's vocabulary, in Illinois productive use has not been defined sufficiently to be meaningful for surface-mined lands. There are those who strongly support the economic approach; even though simplistic, it may be the only acceptable measure of productive use. A compilation of information on farmland values with and without coal deposits in selected counties yielded little information on the value of surface-

mined land (Seitz 1972). Those few values obtained for affected land were considerably lower than values of lands subjected to normal farming practices. Seitz (1972: 29) recommended ". . . action to offset the reduction in tax base . . ." by more stringent reclamation requirements to restore affected land; by altering the tax law either at the state or county level; or by developing these lands for intensive utilization such as industry, residences, recreation, or authorized waste disposal sites. Secondly, Seitz (1972:30) suggested that property tax base and administration for mined land be more uniform between and within counties.

Illinois probably cannot exhibit that its best lands subjected to surface mining, even under the highest reclamation, have been returned to a productivity equivalent to that yielded by previous land use efforts. From an agricultural standpoint, only pasture and hay show productivity near that of improved non-mined land. It is a long, slow process in returning mined lands to high levels of productivity for intertilled crops. However, changes in use, such as removing land from idle and fallow use to recreation, cattle grazing, or, in some cases, forests, may be more rapidly accomplished. Certainly, it is reasonable to question the application of "previous use" as a guideline for reclamation. Surely, new types of land use might be more realistic (in many areas). We insist on flexibility to allow for new land-use ideas and to capitalize on innovative designs in land formation.

With regard to reclamation, there is the philosophical question as to the acceptance of revegetation through natural processes. Pre-law lands, not subjected to man's reclamation efforts, reflect various degrees of revegetation depending on conditions for plant growth. Those factors, or combination of factors, vary not only between regions of the state but also within a region or even at a given mine location. Broadly, the factors responsible can be categorized as the technique of handling the overburden, the natural characteristics of the overburden and the methods of disposal of residues resulting from processing the coal. Directly reflected in the conditions of such spoils and waters is the concern of the coal company for adverse effects resulting from its mining operations.

Natural processes are somewhat slower in providing vegetation protection and they are without direction except as characterized by plant succession of the region. Certain unique situations of subsequent use can be envisioned for such sites, but this is not reflected in the land value. An area unreclaimed is appraised at decidedly less than where there is man-made reclamation. Because the latter occurs more rapidly there is, theoretically, a more immediate economic impact on

the community. Because of all these factors, plus the knowns and unknowns related to reclamation that include extensive grading, one must question the feasibility of attempting extensive renovation of all surface-mined areas that were not subjected to the more stringent requirements beginning in 1968. More plausible would be full attention to the resolution of the truly problem conditions with minimal efforts in land manipulation for others. But, these latter should be included in regional planning so as to fully capitalize their potential economic contributions. Finally, we suggest that technology should develop not only new techniques of reclamation, but also new techniques of extraction, which would couple methods of surface mining with those of underground mining thereby reducing the acreages of land overturned while allowing the efficient extraction of coal.

ACKNOWLEDGMENTS

Special appreciation is extended to Mr. E. E. Filer, Division of Land Reclamation, Illinois Department of Mines and Minerals, and Mr. L. S. Weber, Mid-West Coal Producers Institute, Inc., for their contribution and collaboration in supporting the surface-mine research efforts of Southern Illinois University at Carbondale, Messrs. Ronnie Haynes and Ernest Ashby are recognized for their efforts in the recent field survey and subsequent data analysis. We particularly acknowledge the financial support provided by the Illinois Departments of Conservation and Mines and Minerals and the Illinois Institute for Environmental Quality.

LITERATURE CITED

Anonymous.
1968. Surface-mined land reclamation act and rules and regulations. Illinois Dept. Conserv. 30p.

Anonymous.
1972. Reclamation of strip mined land in Illinois. p. 1-16. In: Illinois Blue Book 1971-1972 (J. W. Lewis, ed.). State of Illinois. 856p.

Arata, A. A.
1959. Ecology of muskrats in stripmine ponds in southern Illinois. J. Wildl. Manage. 23(2):177-186.

Averitt, P.
1968. Stripping coal resources of the United States. U.S. Geol. Bull. 1136. 116p.

Birkenholz, D.
1958. Reclamation of a spoil-bank area for wildlife purposes. M.S. Thesis, Southern Illinois Univ., Carbondale. 70p.

Brewer, R. E.
1958. Breeding bird populations of strip-mined land in Perry County, Illinois. Ecology 39(3):543-545.

Croxton, W. C.
1928. Revegetation of Illinois coal-stripped lands. Ecology 9:155-175.

Deitschman, G. H.
1950. Comparative survival and growth of trees planted under three types of overhead cover on strip-mined land in southern Illinois. U.S.D.A. Central States For. Exp. Sta. Note #63. 2p.

Filer, E. E.
1969. Annual Report 1968: surface-mined reclamation. Illinois Dept. Conserv. 9p.

———.
1972. Annual Report: surface-mined land conservation and reclamation. Illinois Dept. Mines and Minerals. 58p.

Grandt, A. F.
1952. Agronomic land use research on the mined areas of the stripped coal lands of Illinois. Univ. of Illinois Agric. Exp. Sta. Prog. Rept. 56p.
———, and A. L. Lang.
1958. Reclaiming Illinois strip coal land with legumes and grasses. Univ. of Illinois Agric. Exp. Sta. Bull. 628. 64p.
Haynes, R. J.
1972. Survey of coal surface-mined areas in Illinois. Second Annual Rept. Coop. Wildl. Res. Lab., Southern Illinois Univ., Carbondale. July. 4p. (Typed).
———, and S. R. Jewell.
1973. A survey of lands surface mined for coal in Illinois. I. Illinois surface-mined lands affected prior to January 1, 1962 (pre-law). A preliminary report. Illinois Dept. Mines and Minerals and Inst. Environ. Quality. 70p.
Klimstra, W. D.
1959. The potential of wildlife management on strip-mined areas. Illinois Wildl. 14(2):5-9.
Lejcher, T. R.
1971. Palzo reclamation study. Progress Report. Shawnee Nat. For., U.S. For. Serv. 23p.
Limstrom, G. A., and G. H. Deitschman.
1951. Reclaiming Illinois strip coal lands by forest planting. Univ. of Illinois Agric. Exp. Sta. Bull. 547:199-250.
McDougall, W. D.
1918. Plant succession on an artificial bare area in Illinois. Trans. Illinois State Acad. Sci. 10:129-131.
———.
1925. Forests and soils of Vermilion County, Illinois, with special reference to the "striplands". Ecology 6(3):372-380.
McGrath, J.
1972. Some aspects of soil nutrients in spoilbanks of a southern Illinois stripmine. M.S. Thesis. Southern Illinois Univ., Carbondale. 82p.
Myers, C. W. and W. D. Klimstra.
1963. Amphibians and reptiles of an ecologically disturbed (strip-mined) area in southern Illinois. Amer. Midl. Nat. 70(1):126-132.
Riley, C. V.
1954. The utilization of reclaimed coal striplands for the production of wildlife. Trans. 19th North Amer. Wildl. Conf.: 324-337.
———.
1957. Reclamation of coal strip-mined lands with reference to wildlife plantings. J. Wildl. Manage. 21:402-413.
Roseberry, J. L.
1963. Report on a survey of potential recreational utilization of Illinois strip-mined lands. Coop. Wildl. Res. Lab., Southern Illinois Univ., Carbondale. Mid-West Coal Producers Inst., Inc. 11p.
———, and W. D. Klimstra.
Comparative ecology of spoilbanks resulting from two techniques of surface mining coal. Unpubl. manuscript.
Seitz, W. D.
1972. An analysis of strip-mining and local taxation practices. Illinois Agric. Econ.: 23-30.
Simon, J. A., and W. H. Smith.
1968. An evaluation of Illinois coal reserve estimates. Proc. Illinois Mining Inst. 76: 57-68.
Smith, W. H., and R. Agaste.
1966. Unpublished "Letter Report: Areas of strippable coal reserves in Illinois less than 100 feet deep." Illinois State Geol. Surv.
Verts, B. J.
1956. An evaluation of wildlife and recreational values of a strip-mined area. M.S. Thesis. Southern Illinois Univ., Carbondale. 61p.
———.
1957. The population and distribution of two species of Peromyscus on some Illinois strip-mined land. J. Mammal. 38(1):53-59.
———.
1959. Notes on the ecology of mammals of a strip-mined area in southern Illinois. Trans. Illinois State Acad. Sci. 52(3 & 4):134-139.
Vohs, P. A., and D. E. Birkenholz.
1962. Response of bobwhite quail to management on some Illinois strip-mined lands. Trans. Illinois State Acad. Sci. 55(1):13-19.
Weber, L. S.
1962. The administration of the Illinois strip mine reclamation act. Proc. Illinois Mining Inst. 70:52-59.
Yeager, L. E.
1940. Wildlife management on coal stripped land. Trans. 5th N. Amer. Wildl. Conf.: 348-353.
———.
1942. Coal-stripped land as mammal habitat with special reference to fur animals. Amer. Midl. Nat. 27(3):613-635.

STRIP MINING IMPACTS AND RECLAMATION EFFORTS IN APPALACHIA[1]

ROBERT LEO SMITH
Division of Forestry, West Virginia University, Morgantown

Strip mining is not new to Appalachia. Although the great expansion in strip mining took place during the past 25 years and especially during the 1960's it has existed in the mountain country for some time. Early strip mines involved a few workers, often only the landowner's family, who opened up the coal along an outcrop line with pick, shovel and wheelbarrow and sold it to the local blacksmiths. The first mechanical method of strip mining in the mountains was introduced into Laurel County, Kentucky in 1870 (Camplin 1965). The overburden was removed by horse-drawn plows and scrapers and the coal was hauled away in wheelbarrows and carts. This method of mining was followed by the introduction of the steam-operated stripping shovel in 1905 in the same county. Since that year strip mining has spread rapidly through the mountain country with disastrous ecological results.

Because of its hilly and mountainous terrain, the most common method of surface mining in Appalachia is *contour strip mining*. Contour mining is done on the slope. To get at the coal the operator makes his initial cut starting at the outcrop. The overburden is cast down slope to form a spoil bank on the original slope of the land (Figure 1). The base of the spoil bank is called the toe, and the outer face of the spoil is the outslope which normally achieves the angle of repose of the overburden material. Removal of the overburden produces a bench which consists of two parts. One is the solid bench, the portion from which the overburden was removed. It is underlain by solid rock and before it is removed, the coal. The outer part is the fill bench, composed of spoil which was deliberately pushed downhill. Shaped like an inverted triangle lying along the hillside, the fill bench widens the bench upon which additional spoil can be piled. On the inside is the highwall of unexcavated material which may range from a few to more than 100 feet in height.

To begin the operation the dozers come in to remove the relatively loose overburden. Once this is accomplished the driller makes shot holes. Charges of ammonia nitrate mixed with diesel fuel are lowered into the holes and set off. The object is to shoot the overlying strata down to but not including the coal. The dozers move in again and shove the broken stone and boulders downslope largely burying the

[1] Approved as Scientific Paper Number 1260, West Virginia University Agricultural Experiment Station.

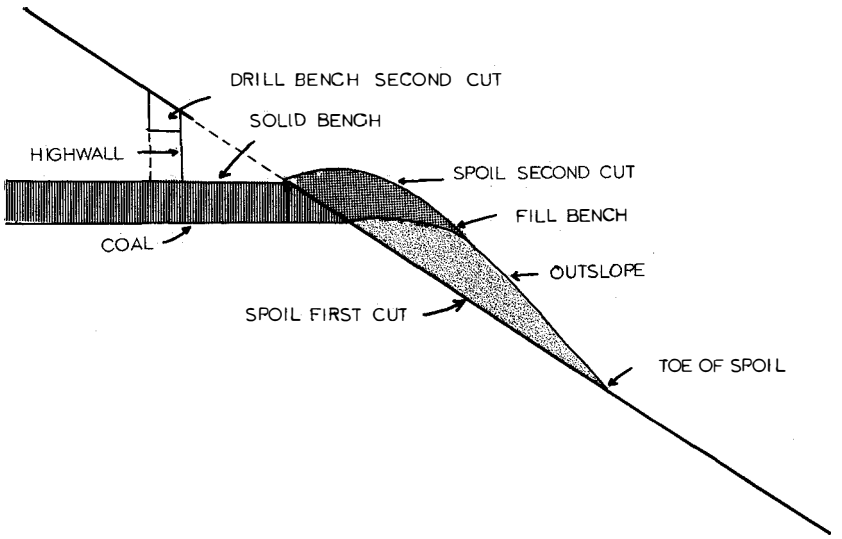


Figure 1.—Diagram of a contour strip mine showing features.

finer material first removed. When the coal seam is exposed the operator uses a front-end loader to remove the coal.

How far back the operator can remove the coal depends upon the depth of the overburden. Eventually he arrives at a point where the ratio of the overburden to the product brings the operation to a halt.[2] At this point the larger operators, at least, may employ ***auger mining*** to remove as much of the remaining coal as possible. This is accomplished by boring horizontally into the seam and extracting the coal in the same manner as shavings are produced by a carpenter's bit. Cutting heads may be as large as seven feet in diameter; and by adding extensions behind the cutting heads, holes may be drilled as deep as 200 or more feet. In other situations contour stripping may be a means of opening up coal seams under the mountain for punch or drift mines. Stripping the outcrops first is the most economical way of deep mining coal in the mountains, since it eliminates the necessity of constructing deep shafts.

In much of the southern and central Appalachians more than one seam of coal outcrops on the mountainside, which encourages multiple seam mining. In this situation the operator starts on the lower seam first (Figure 2). When the stripping of the first seam has progressed

[2] **This relationship is expressed as the ratio of cubic yards of overburden to the thickness of coal in feet. Spoken of as the stripping ratio, a ratio of 15 to 1 means that 15 feet of overburden can be removed for every foot of coal. Thus for a four-foot seam, the operator could remove 60 cubic yards of overburden.**

Figure 2.—Multiple seam mining in southern West Virginia.

far enough, the operator starts on the next seam above. The same procedure as before follows. Dozers push what material they can down slope. Then the overlying strata are shot and pushed down onto the inside part of the bench below, covering the opening made by the auger mining and a considerable portion of the floor of the first coal bed. And so it goes one seam after another until the last one near the top of the mountain is reached.

If the upper seam is near the top, the operator will *area strip*. In this method the operator makes a trench or box cut through the overburden to expose a portion of the seam. When that part is removed he makes a parallel cut and the spoil is deposited in the cut previously made. The final cut can leave an open trench equal to the overburden and the coal recovered, bounded on one side by the spoil and on the other by a highwall.

When the coal is removed the mountainside has been converted into a series of level terraces joined by rocky outslopes, like giant steps up the mountainside.

RECLAMATION

Largely because of public pressure, legislative action requires strip-mine operators to regrade strip-mining sites, bury toxic materials and revegetate the area. Laws and regulations vary considerably among the states. Virginia, for example, has virtually no law at all and Tennessee's is full of ambiguities. Pennsylvania, West Virginia and Kentucky all claim to have the finest reclamation laws and regulations. Among these three states each has strong points and weak, and in each the laws are only as good as the regulatory mechanisms behind them. In general these regulations require the operator to post bond of up to 1000 dollars an acre of land to be disturbed; submit detailed plans on reclamation and treatment facilities for draining water from the site; secure proper permits after his plans are approved; backfill and regrade as the job progresses, and reclaim to the satisfaction of standards as prescribed in the regulations. When reclamation meets specification, the bond is lifted and the area is accepted as reclaimed.

In details the regulations among the states vary. In West Virginia the operator may select the type of vegetation he will plant from a mixture approved by the Department of Natural Resources and must meet minimum fertilization requirements. The area cannot be considered revegetated until after the second growing period and, depending upon the mixtures used, a certain percentage of ground must be covered. For grasses and legumes this is 80 percent. Most operators go for a grass-legume or grass mixture. In Pennsylvania the operator may be required to plant trees and grass, especially in hilly terrain, but the law does not specify the percentage of ground cover required. Pennsylvania law requires that operators save and spread topsoil in all operations, a regulation missing in those of Kentucky and West Virginia. Pennsylvania law describes the manner in which toxic materials must be returned to the pit, compacted and interlayered with non-toxic material, a stringent regulation found only in that state. Pennsylvania regulations, in contrast to those of West Virginia and Kentucky, rigorously defines "water" to which regulation apply and specifies permissable standards for water discharges relative to pH, iron content, acidity and alkalinity. If auger mining is employed, Pennsylvania requires that auger holes be sealed to a minimum of six feet in depth with impervious material before backfilling begins. Pennsylvania laws ban the Broad Form deed,[3] Kentucky still recognizes it.

Of regulations specifically applicable to mountain country, West Virginia permits strip mining on slopes up to 65 percent (30°). Where the original slope exceeds 65 percent and a fill bench is produced for haulageway, no mineral can be removed by any method. Kentucky on the other hand permits only auger mining on slopes of over 65 percent. West Virginia requires that no highwall shall exceed 30 feet in height. Pennsylvania permits no highwall and requires contour backfilling and reclamation to original contours; in special situations terrace backfilling, if necessary, is permitted. These few examples give some idea of the variations among state regulations, each of which has its own weaknesses and failure to fully protect the environment.

ENVIRONMENTAL IMPACT

Strip mining is an assault on the land. In the Appalachian regions the environmental damages vary from region to region depending upon the terrain and the type of overburden. In more rolling country damage is less and reclamation is more successful. In the steep mountain country of West Virginia and Kentucky and parts of Virginia and Tennessee the damage can be enormous, particularly where multiple seam mining is involved (Figure 2). Because the steep mountainous regions contain most of the strippable reserves and the most valuable coal seams many of the counties can be completely affected.[4]

The impact of surface mining and the failure of reclamation in the steep Appalacians has to be experienced to be appreciated.

The southern mountains are a product of millions of years of geological erosion. This erosion reduced a broad flat peneplain to a jumble of narrow ridge tops and deep V-shaped valleys. The erosion still continues. If one tramps through these mountains long enough, it is evident that the soil is still slipping down the slope, although very, very slowly. The narrow valleys or hollows still are being cut deeper. But the soil is held by forest growth and there is little sediment produced. In effect the mountain slopes appear relatively stable.

But when the mountainsides are cut away by contour stripping, conditions are radically changed.

Over much of the strip-mined area, the vegetative cover that holds the soil is completely destroyed with enormous consequences. The

[3] The Broad Form deed permits the owner of mineral rights to strip mine the surface whether he owns the surface or not. The surface owner has no rights.

[4] In West Virginia, for example, counties with less than half of their lands in slopes greater than 25 percent contain six percent of the surface mining reserve and 20 percent of current (1970) production while counties with more than three-quarters of land in slopes greater than 25 percent contain 58 percent of the reserve and 40 percent of current production (SRI Report, 1970).

southern mountains are covered largely by forests. The forest vegetation breaks the impact of the rain.[5] The litter acts as a blotter absorbing the water and allowing it to percolate slowly down through the soil until it reaches deeper water tables. The water slowly feeds the streams and springs that arise up in the heads of the hollows. In summer a good deal of the water is utilized and transpired by trees, reducing the amount that feeds into streams. The litter layer also slows down the leaching and weathering process. The nutrients released by weathering are taken up by the trees, utilized and stored in leaves, twigs, bark, and trunk. Part is returned to the litter in the form of leaf fall to be recycled again.

Once the forest cover is removed and the area torn up by bulldozers, the natural cycle that evolved over long periods of time is destroyed. Root systems that can hold the soil even after the trees are cut, are torn away, eliminating the only real anchor of the soil to the slope. Water that once slowly fed into the soil now rushes down the slope. Great quantities of water that would have been taken up by the trees and lost to the atmosphere are added to the amount of runoff. Preliminary studies by Dr. Richard E. Lee, West Virginia University, show that surface mining in a watershed decreases the evaporation and transpiration in summer (May to October) and increases streamflow during that period.

Nutrients that were once slowly leached and recycled are now subject to rapid weathering and chemical action. Elements that are necessary in small amounts become toxic to plants when released in great amounts. Carried away in high concentrations by water coming off the stripped slopes, these elements reduce water quality down stream. In areas backfilled and reclaimed according to specification and even on level land, this type of weathering continues. Studies by Neely *et al.*, (1971), at Case Western Reserve show that the pH of runoff from reclaimed areas in limestone country of Ohio may go as low as 2.8 compared to a pH of 7 from undisturbed land. Even treatment of runoff with lime brought the water up to only a pH of 3.9. Leaching of sodium from the stripped sites was four times that of the unstripped sites; leaching of calcium was 23 times as great, manganese 236 times as much and aluminum 3000 times as much. Both aluminum and manganese in the quantities being leached from the sites are highly toxic to plant life.

In the mountain country conditions are as bad. This is emphasized in the report of the U.S. Geological Survey of the Beaver Creek Basin in Kentucky (Collier 1970). There dissolved solids coming from

[5] The importance of forest cover in this region was stressed as far back as 1884 by N. S. Shaler.

stripped sites were 12 times greater than from unmined sites, and sulphates were 50 times greater. The duration of major effects were expected to last at least ten years. In fact while the amount of leaching of toxic materials decreases rapidly after mining operations the half life of toxic spoil materials in the mountains of West Virginia and Kentucky is 125 years for sulphur, 100+ years for magnesium and 1000+ years for aluminum (Vimmerstedt and Struthers 1968).

Strip mining increases manyfold the natural instability of the slopes. The rocks that make up the matrix of the mountains are relatively stable and protected from excessive weathering by the mantle of soil covering them. They are compressed and little of their total volume is subject to weathering. But when the rocky material is bulldozed and blasted away from the underlying coal and pushed over the slope the volume of the material is increased by over one-third (SRI Report, 1971). Massive blocks of rock are broken into pieces. The surface area of the material is greatly increased, exposed to air and water, and subject to rapid weathering.

The mixture of soil and rock that makes up the overburden, which may be 25 or more feet deep, is often so deposited that the outslope is steeper than the original slopes. Loose, highly impervious to water, with the minimal amount of overburden at the bottom of the slope and the bulk of the weight on the spoil bench, the outslope is subject to slippage and mass movement. Natural geological forces and gravity that combine to cause the inherent stability on the undisturbed slopes act with an even greater force on the loosened material. The whole mountainside then moves down to the valley.

Heavy rains hammering on the outslopes becomes runoff that makes its own channels in the spoils. The channels grow into gullies even on the revegetated slopes. Water rushing down the gullies carries sediment to streams. The erosive force of the water and slippage carries tons of silt downslope. In one area of West Virginia, the Coal River watershed, an estimated 19,700 tons of sediment per year are carried away by the waterways (SCS 1969). Sediment yield from spoil banks may run as high as 1000 times the amount that comes from undisturbed forested slopes, and the erosion rate is five to ten times as much (Collier, 1970). There is little indication that coal industry is going to be able to stop the massive accelerated erosion that have been unleashed in spite of reclamation efforts.

In some watersheds the situation becomes critical. The Coal River watershed, comprising nearly all of Boone, one third of Raleigh and a portion of Kanawha, is one of the most threatened environments in West Virginia. Strip mining has disrupted drainage patterns, reduced water retention, reduced depth of stream channels, increased peak runoff, created extensive land instability with erosion, resulted in

siltation of streams with its destruction of aquatic life. All this combined has increased the flood potential and flood damage in the region. Indeed the Stanford Institute Report on strip mining in West Virginia, not given to making recommendations, questions "whether granting of new permits in the area is consistent with the achievement of satisfactory environmental conditions and for the achievement of desirable postmining uses of the land."

An objective of reclamation is to restore the disturbed land to some productive use. In the southern mountains it is obvious to anyone who views strip mine reclamation that reclamation is not successful, nor is the land being restored. It is impossible to put the excavated material back and to reestablish any semblance to previous ecological conditions, a result that can be at least partially accomplished in less rugged country. Forest vegetation is not being restored. What the area was and what it becomes is a study in contrasts.

The mountains of the southern Appalachians were once covered with one of the finest stands of hardwood timber in the world. The magnificent stands are gone. But in spite of past and present abuses, the slopes still grow fine timber. The growth potential of the cove-hardwoods forest type has no equal. The north and east facing slopes possess the moisture and nutrients necessary to provide ideal sites for such important hardwood species as black walnut, cherry, white ash, red oak and yellow poplar. Although many of these sites have suffered from poor management and fire, they are capable of growing fine timber today.

Strip mining, especially multiple-seam mining, destroys present stands of timber on the site and so disrupts the environment that it appears impossible for any forest regrowth in the foresseable future. The rich sites are either destroyed directly by stripping or else they receive the brunt of overburden and siltation from the stripping at high elevations. It will take hundreds of years for any kind of forest growth to return to the strip-mined slopes. And one can question whether anything comparable to Appalacians hardwoods will ever return.

In place of the Appalachian hardwoods, the coal industry gives us grass. Not top-quality grasses but species that are capable of at least short-term growth on environmentally severe sites: such as weeping lovegrass, Kentucky 31 fesque, and perhaps such other plants as sericea lespedeza and black locust. But these grass species are relatively short-lived, from two years for lovegrass to perhaps 10 for sericea (Vogel and Berg 1968, Vogel 1970). On level to moderate slopes the use of grass is a natural way to restore the area since grass is a successional stage back to forest. But unless care is taken to replace sufficient topsoil and to cover toxic materials, revegetation

will not last. Even if the toxic materials are covered, there is no guarantee that the elements will not come to the surface and inhibit the growth of plants.

In the southern mountains the demise of the vegetation is almost assured. The nature of the spoil is critical, and the long outslopes are largely rock material with no topsoil. To save the topsoil and to cover such material is almost impossible. By hydroseeding and by applying a heavy initial application of fertilizer, the surface-mining industry can achieve some degree of planting success on the benches and the upper portions of the outslope, at least for a year or so, long enough to meet reclamation requirements. But what then? Infrared photography indicates that revegetation of Bolt Mountain in West Virginia, a site considered a showcase of mountain reclamation, did not result in a healthy stand of grass. Information suggests that complete failure of the plantings is not far off.

In spite of reclamation efforts, planting of grass is successful only in places. The success of revegetation is related to the aspect of the slope as well as the nature of the overburden. South-facing slopes are especially difficult to revegetate due to the extremes of high surface temperatures and the lack of moisture. And on no slopes can grass stabilize the soil. If the earth is disturbed and replaced at an angle exceeding 32 degrees on the horizontal the resulting slope cannot be considered stabilized. Where such spoils are placed on steep slopes with weak foundations characteristic of mountain slopes, frontal failures occur and the entire face of the bank begins to slide (Weigle 1966). This is a common sight on many of the reclaimed outer slopes. In spite of revegetation these slopes will be subject to erosion and slippage for years to come.

Fertilization is an integral part of revegetation. However the leaching of fertilizer from the spoils can return a site to a nutrient-poor condition and have an adverse effect on the revegetated slope. Who is to be responsible for the maintenance and refertilization of revegetated slopes once the area is abandoned?

Further, the life span of vegetation is short. Unless industry continues treatment to control acidity, if indeed that is possible[6] and maintain nutrient levels of nitrogen and phosphorus, grass may persist only a few years. After this time the vegetation will decline, reclamation will be reversed, and as the SRI Report suggests, new orphaned lands[7] will result.

[6] Studies in Ohio indicate that attempts to neutralize acidity on strip mined lands is relatively ineffective. Lime applied at a rate of 42 tons per acre were ineffective in highly acidic areas (Sutton, 1970).

[7] Orphaned land is a coal country name given to strip-mined lands abandoned without any efforts at reclamation.

Thus it appears that reclamation in the steep southern mountains is impossible except in very favorable situations. As strip mining continues it has the potential of turning the mountainous Appalachians into a devastated, uninhabitable, economically ruined region. The trend has already started in parts of Appalachia. Boone County, West Virginia, serves as an example (Cubbison and Dunlap 1972). At present more than seven percent of Boone County has been destroyed by strip mining including highwalls, benches, spoil slopes and overburden. If stripping continues at the current rate, one in every four acres in Boone County will be disturbed by 1980.

Virtually all of Boone County can be stripped to obtain 310 million tons of remaining reserve. Strip coal reserves make up 6.5 percent of the total minable reserves of 4.6 billion tons. In other words the entire county can be destroyed by strip mining to obtain only 6 percent of the available coal. Boone County is experiencing economic decline. Its population has dropped sharply during the past 20 years. From 1960 to 1970 its population declined 13 percent and its age structure changed to one characteristic of an aging population (R. L. Smith, unpublished data).

The trend can only continue as more and more of the mountains are devastated, making the region an intolerable place in which to live.

Throughout the Appalachian region the problems of strip mining vary widely. Because of a topography that changes from rolling countryside of western Pennsylvania to hills of northern West Virginia to the sharply dissected steep-sloped mountains of southern West Virginia, eastern Kentucky, Tennessee, and southwestern Virginia, one cannot generalize about the effects of strip mining. In the northern coal fields some reclamation is successful, particularly in western Pennsylvania where the topsoil has to be set aside. In the mountains of southern West Virginia and eastern Kentucky industry attempts to revegetate loose rocky steep-sloped spoils are notable failures. They cannot cope with the situation. Because of both the nature of the topography, the presence of low-sulphur coal, and the extent of strip mining which can involve both sides of a mountain, the impact of strip mining is most devastating, threatening the economic future of the region. The environmental damage is so great that regardless of ownership, or the energy crisis, one has to question whether any one corporation or government has the right to hand over to the next and future generations land in such a hopeless state.

LITERATURE CITED

Camplin, P.
1965. Strip mining in Kentucky. Kentucky Department of Natural Resources, Frankfort. 56 p.

Collier, C. R.
1970. Influence of strip mining on the hydrologic environment at parts of Beaver Creek Basin, Kentucky, 1955-66. U.S. Geological Survey, Professional Paper 427-C.
Cubbison, E. and L. C. Dunlap.
1972. Stripping the land for coal; only the beginning. State and county projections. Coalition Against Strip Mining, Washington, D. C.
Neely, James C., *et al.*
1971. The ecological effects of strip mining: a comparative study of natural and reclaimed watersheds. Paper presented at Case Western Reserve Univ., August 20, 1971.
Shaler, N. S. (ed.).
1884. Report on Greenup, Carter, Boyd and Laurence Counties. Geological Survey of Kentucky, Frankfort.
Stanford Research Institute.
1972. A study of surface coal mining in West Virginia. Technical Studies. Prepared for the West Virginia Legislature.
Sutton, P.
1970. Reclamation of toxic coal mine spoil banks. Ohio Report on Research and Development. 55:99-101.
Vimmerstedt, J. P. and P. H. Struthers.
1968. Influence of time and precipitation on chemical composition of spoil drainage. Second Symposium on Coal Mine Drainage Research Mellon Institute. Pittsburgh, Pa. May 14-15, 1968.
Vogel, W. G.
1970. Weeping lovegrass for vegetating strip-mine spoils in Appalachia. Proc. First Weeping Lovegrass Symposium, 152-162.
———— and W. A. Berg.
1968. Grasses and legumes for cover on acid strip mine spoils. J. Soil and Water Conservation, 23:89-91.
Weigel, W. K.
1966. Spoil bank stability in eastern Kentucky. Mining Congress J. April, 1966 (Reprint).

STRIP MINING: CONFLICT OR COMPETITION?

RODNEY KRAUSE

Director of Reclamation Services, National Coal Association, Washington, D. C.

The topic of discussion for this panel is strip mining: resources in conflict. I would like to suggest, however, that the resources which are strip mined are in competition with the environment rather than in conflict with it. I suggest this because conflict implies an ultimately destructive process, and I do not believe that strip mining need have this effect. Competition, on the other hand, connotes a healthy tug between two forces which usually results in productive advancement. While there may have been a time when mining and the earth were in conflict, I believe that our progress in both philosophy and technology have brought us to the point where surface mining and the environment can coexist and thrive.

I believe that both strip mining for coal and the reclamation of surface-mined land can be carried out intelligently. Thus viewed strip mining simply competes with other land uses, such as farming, housing and recreation areas, for a time and place in the land's total history.

Strip mining can be done on almost any terrain; *how* it is done determines successful or unsuccessful reclamation. Sound reclamation

can take place anywhere *if*—and this is a very big if—the mining and reclamation procedures are properly planned and executed.

Coal strip mining is usually characterized as either area mining—which takes place in the relatively flat lands of the Midwest and western states—or contour mining, which is common in the mountains of Appalachia. In area mining, the overburden covering a segment of coal is removed and stacked in a ridge next to the deposit. The coal is then removed, and a second segment of overburden is placed in the trench created by the first cut, uncovering a second deposit of coal. This process is continued until all the coal in a seam has been removed, leaving a series of parallel ridges of overburden.

In contour mining, the operator exposes the coal by removing the overburden from a hillside in a series of slices which meander their way around the mountain, exposing the coal deposit for mining. The spoil material is placed on the outslope of the mountain.

There are, of course, variations of technology and equipment used in both area and contour mining. The old "uncover, load and haul" maxim employed in both methods can be modified to suit local conditions and to facilitate both mining and reclamation.

An example of modifying the area method exists in southwestern Illinois. There a stripping unit was designed to uncover two separate seams of coal and place the stratum of overburden best suited for growing plants so that it will be on top after the spoil is graded. This operation called for considerable preplanning—a special machine method for mining both coal seams had to be devised, the best layer of the overburden had to be identified through testing and the shovel and dozer operators had to be trained to deposit and grade the earth according to the new plan. The result, however, has been a highly successful reclamation program, reducing the amount of time and money necessary to get the land back into usable shape after it is mined.

Such operations are not uncommon in regions where coal is area mined. But such coordination becomes, in my opinion, a necessity in contour mining where the land is mountainous. The effects of mountain mining as practiced in the early, and in some cases not so distant, past are all too familiar. Until quite recently, contour mining simply involved cutting a road up the mountain to the coal outcrop, drilling and shooting the overburden and shoving the spoil down over the outslope. When the slope became overloaded, the result all too often was mudslides, massive sheet erosion, severe gullying, sedimentation and siltation.

The end product of such unplanned, uncontrolled and unregulated mountain stripping brought a public outcry, state legislation and a

new breed of mountain miners. These men recognize strip mining for what it really is—an earth-moving job pure and, in many cases, not so simple.

Since earth moving, as related to strip mining, is still a developing technology, it is too soon to say that it has reached its maximum development. It has, however, reached the point where, by applying the proper tools and sound conservation and engineering practices, mined land can be returned to a useful state in relatively short order.

By employing known principles of engineering, hydrology, geology and botany, surface mine operators can effectively combine efficient mining with successful protection of the environment. Neither needs suffer if we apply the knowledge that we have gained from years of experience in erosion control, highway construction, the building of houses and other earth-moving projects.

One fundamental concept in planning good reclamation work is that the less land that is disturbed, the less there is to reclaim. While this may seem a simplistic axiom, it is one, nevertheless, which has been too often ignored, resulting in some of the problems we discussed earlier. For instance, where large quantities of overburden are placed on the outslope of a mountain during mining, slides and erosion are likely to occur. As a consequence, the number of acres affected by mining becomes much greater than the actual acres mined.

Realizing the inefficiency and futility of this situation, many operators have experimented in recent years to develop methods which will minimize the amount of land affected by mining. One such method is called the slope-reduction or pushdown method: the overburden from the first cut into a hillside is spread out uniformly over a predetermined length of the outslope with the result that the hillside is made less steep and less slide and erosion prone. The area is also made available for seeding or planting while the mining operation proceeds on the bench above, since no overburden after the first cut is cast onto the outslope.

Another method called the boxcut reverses the conventional two-cut process by making what would ordinarily be the second cut into the mountain first. This is done with a highfront shovel and the overburden is temporarily placed on the mountainside while the coal from the cut is removed. Then the overburden is returned to the cut and the overburden is removed from above the deposit just downhill from the first cut. It is placed above the first cut and the spoil is graded back against the highwall and seeded. The end result of this imaginative procedure is that no overburden remains permanently over the outslope, so again the likelihood of slides and erosion is virtually eliminated.

Yet a third innovation in mountain mining is the valley fill, or head of the hollow, method which uses the space of a small, narrow valley to store overburden from the enclosing mountains. The effect is the creation of an earthen dam containing earth materials rather than water, with provisions for internal and surface rainfall control built in. The attraction here is that the method eliminates miles of outslope with its potential for slides and erosion and in most cases also eliminates the highwalls because the entire coal seam is mined, leaving a large expanse of gently rolling or flat land on top of the mountain.

Another method which is becoming more common is what I call the throw-it-over-your-shoulder method. Again it hinges on the concept of disturbing as few acres as possible in the mining procedure and its aim is to keep overburden off the outslope. To do this, the operator moves the overburden parallel to the highwall instead of moving it at right angles and pushing it out over the outslope. The highwall as such is eliminated and the operator has the option of grading the best layer of overburden into position before he begins planting.

It may sound as if all the action is confined to the hill country, but such is not the case. For example, in area mining a major consideration is the shaping of the long parallel rows of overburden ridges into a usable land management unit. This phase of the operation is normally carried out with the largest available bulldozers carrying either a straight or U blade. Earth-moving rates of 600 cubic yards per hour are not uncommon for this kind of equipment, but it is a long way from being the most efficient way of using horsepower.

Breaking the 600-yard barrier began when a land reclamation contractor in southeast Kansas modified a conventional 20-foot blade by increasing its angle. He built a hooking device to attach a cable from the leading edge of the blade to a tow tractor and with his souped-up machine moved some 3,000 cubic yards per hour.

A reclamation engineer named Jake Howland, who operated on the theory that there is nothing made that cannot be improved, conceived the 40-foot angle blade. Set at an angle of 39 degrees (the normal angle is 25 degrees) the blade is controlled hydraulically. A heavy lubricant is injected at various points along the blade to reduce friction and sidethrust. Hooked onto a D9G the blade has moved over 7,000 cubic yards per hour, and Mr. Howland is working on a 60-foot angle blade powered by a bulldozer of at least 1,500 horsepower.

These improved machines mean that a more desirable land form can be achieved at a significant reduction in time and money. In those parts of the country which have orphan or pre-law mined lands, the cost of reshaping can be greatly reduced. And at operating mines such

a tool is of great help in keeping the reclamation process current with mining.

The ultimate measure of success in a land reclamation program which involves vegetation is how well the planting grows and sustains itself over the long term. I have no quarrel with those who call for what has been termed "instant green," the result of large amounts of seed and fertilizer used immediately after mining to help stabilize the soil and reduce erosion. But such action is aimed at the short term and in conjunction with it, a longer range plan for vegetation is needed.

One such plan is the establishment of a forestry program which takes into consideration the short, medium and long range reclamation needs of mined land. The idea is to use as much of the growing space from the first planting until the ultimate harvest. The method calls for one row of pioneer species, such as black locust and black alders. Both fix nitrogen into the soil and are planted alternately in the same row at the rate of 150 each per acre.

The second row of species is a mixture of fast-growing pulpwoods such as cottonwood, aspen, silver maple and sycamore planted at random at the rate of 300 per acre. The third row are those trees which will ultimately take over and hold the land, such as white oaks, sugar maples, walnuts and borderline species such as tulip poplars, cherry and red oak. These are mixed at random in the row at the rate of 300 per acre.

We can expect the locust borer to infest the locusts anywhere from age five through ten, resulting in a natural thinning and more growing space. In about 16 to 18 years, the black alders can be cut for pulp, providing yet more space.

In about 25 to 30 years, the intermediate row will be ready for a pulp harvest and that row of trees will be clear-cut. Also at this time, the climax row of trees will be thinned of their poorly formed species and the remainder will be left to grow to saw-log age, somewhere between 45 and 60 years. When they are harvested, we can expect another pulpcut from the intermediate species' sprout growth. Good planning for such a cycle will also include food and cover for wildlife for the duration of the plantings.

Of course forest planting is only one of many alternative uses for mined land. There are others, such as farms, recreation areas, orchards, feedlots and housing developments, which have been enormously successful. The decision of the operator as to which of these options he selects should depend on the soil and weather conditions, the general terrain and the needs of the surrounding community. Unless this decision is made before mining starts, the operator will lose valuable time and money in returning the land to productive use.

Sound preplanning is a must in any successful reclamation program, for without it and without the implementation of sound engineering and botanical principles, mining will represent conflict, not competition. We have the tools and the know-how. The urgency now lies in using these techniques to assure the nation that we can strip mine responsibly without permanent damage to our precious land.

DISCUSSION

DISCUSSION LEADER SAMSELL: One cannot help but reflect on the things our land has been subjected to over the past few years from poor forestry, poor agricultural practices and now, another problem, strip mining, which is proof of additional detriment.

It is extremely encouraging to note the national priority in developing legislation directed towards land-use practices. Many of the states are searching for acceptance of adequate surface mine legislation. Federal surface mine legislation is being proposed at the present time and the land-use activities are coming under close scrutiny with the hope that this will lead to a better performance on the part of man and his association with mineral resources, either for development or for agricultural practices.

CHAIRMAN LEONARD: I can only conclude that our panelists have covered the discussion and problems in such complete detail that further discussion from the floor is hardly warranted.

* * *

Report of the Committee on North American Wildlife Policy 1973

REMARKS OF THE SESSION CHAIRMAN

JUSTIN W. LEONARD

Nearly forty-five years ago, in the early period of the modern wildlife management movement, thoughtful leaders foresaw the need for uniform guidelines that could be used by emerging fish and wildlife organizations in working toward common goals.

The first suggestion for national wildlife policy was made in 1928 in a paper presented at the Fifteenth American Game Conference, which was the predecessor of the North American Wildlife and Natural Resources Conference. This paper was presented by John Burnham. As a result of Burnham's suggestion, a resolution was adopted on December 4, 1928, calling for the formulation, enunciation and adoption of a national policy of wildlife conservation and restoration as a basis for cooperative work on the part of all interested organizations and individuals.

A committee of fourteen distinguished conservation leaders, representing a broad range of professional talents, was appointed under the chairmanship of Aldo Leopold to explore the strengths and weaknesses of existing programs, to identify obviously needed goals and to develop policy that would help to attain them.

While emphasis was on huntable species, the document that emerged two years later at the Twentieth American Game Conference was indeed remarkable in the light of its time because it recommended a development of a natural wilderness system, when wilderness preservation was no more than a dream of a few pioneer conservationists. It called for complex training of wildlife managers when the administrative cadre in North America consisted primarily of a few gamekeepers imported from the British Isles.

This policy advocated the expansion of adequate national wildlife refuge systems and cooperation between the United States and Canada in management of migratory waterfowl. In an age when game farms and predator control were considered panaceas, it called for emphasis on natural production through habitat development and through a more understanding and sympathetic attitude toward predators.

A surprising number of objectives and recommendations of that committee have been realized. However, little progress has been made on others and some remain as pertinent as when they were first presented more than four decades ago.

Today in a North America vastly different from what it was in 1928, wildlife conservation faces challenges and opportunities that no one could have foreseen forty years ago and it is with this in mind

that the Wildlife Management Institute, at last year's conference in Mexico City, asked Professor Durward Allen to explore this subject and assume the chairmanship of a multidisciplinary committee of experts to develop a new and comprehensive policy to guide the course of wildlife conservationists in the future.

If it serves no other purpose than to alert more people to the changing challenges and opportunities for wildlife conservation in the coming years and as a stimulus for creative thought and instructive discussion, then this new policy statement will have served an important purpose.

It is now my pleasure to present to you Dr. Durward L. Allen, Professor of Wildlife Ecology at Purdue University, distinguished author, chairman of the Conference Committee for the new North American Wildlife Policy.

REPORT OF THE COMMITTEE ON NORTH AMERICAN WILDLIFE POLICY[1]

This report is a reexamination of principles and programs affecting our wildlife resources. It supplements and updates the historic statement of December 2, 1930, by the American Game Policy Committee. As chairman Aldo Leopold told the Seventeenth American Game Conference, the original committee was primarily concerned with game problems. However, their report did not fail to recognize the important social values of all wild creatures.

Today's great environmental issues are, literally, without limit. In one context or another, we find ourselves dealing with all living things. However, in its concern with policies and management, the committee conceives wildlife to mean, most commonly, free-living animals of major significance to man.

We regard management as the application of knowledge in the regulation and enhancement of wildlife resources for human benefits. Most notably it consists of meeting the habitat requirements of all species, adopting necessary regulations, and providing for enforcement.

In the sense used here, a policy is a course of action recommended as a preferred means of serving the continuing public interest.

In proposing guidelines for administration and management, we abstract, as best we may and without consensus, the findings of experience and research. We build upon the report of 1930 in confidence

[1]Presented by Durward L. Allen, Chairman.

that the total record will provide useful terms of reference for people who face decisions.

As in the past, the major objective is to preserve and improve the wildlife resource. This states our support for the traditional maxim of conservationists, that wildlife should contribute to the greatest good of the most people over the longest time.

This report is addressed most specifically to problems we know best, those of North America. However, it offers substantial ideas that might well be exported around the world. As an independent product of citizen concern, it could help advance the cause of a universal ecology in the minds of people of many nations. We regard this as a conceptual goal for the future.

In its composition, the committee encompasses representation from Mexico and the long-established participation of colleagues in Canada. Since a majority of members are from the United States, the programs of states are frequently referred to. If any criticism is implied, we feel most free in applying it to ourselves. Where the word "state" is used, let anyone who finds it appropriate read "province," or other governmental unit.

Why Again?

We find a new need to affirm or create policy because new standards and rules are emerging in our society. The last half-century has brought great changes, and more are on the way.

Although the future is unpredictable, certain trends are evident. From today's unprecedented peak of population, there will be a further increase in decades ahead. Our resource-consuming technology will continue to grow. Pressures on the environment will exceed anything yet seen, as every kind of natural asset is under accelerating demand.

This may describe a creeping crisis. However, somewhere ahead men on earth are likely to encounter a period of ultimate trial. That could be a time when too many people in a vastly overtaxed environment will find wisdom to match their knowledge. They may then permit their numbers to decline to a level where lives of dignity and fulfillment can be available to all. This outlook faces hard realities, but it offers a hopeful future and should be a constructive basis for policy making.

For now, we must prepare for tensions and shortage. Wildlife and outdoor pleasures are the most fragile and vulnerable part of our living standard. How will they rank in times of resource emergency?

They will need public acceptance as a competing value in our uses of land and water. They will require high priority in political and

economic decisions. Otherwise they will be lost in the present, and their future will be foreclosed.

In a sense, our program for wildlife is a holding action. Today and in years immediately ahead, the first big job is to prevent irreversible losses—of species, populations, and life communities.

But an equal challenge is to prevent a cultural loss. Widely varied patterns of living are among the many kinds of diversity that enrich the human experience. In our rapidly urbanizing population, many are already estranged from outdoor interests, earth knowledge, and pioneer skills. These elements in our culture should remain available to generations beyond our own.

The Record of Progress

The first policy report was outstanding in its far-sightedness. It described problems that are still with us, but it also saw needs that have been largely fulfilled. There are important entries in the credit column:

Large acreages of land and water, in public ownership, are dedicated as wildlife habitat and devoted to public use.

Wildlife management has been professionalized. Many colleges and universities offer a wildlife curriculum and its supporting courses in biological, social, and earth sciences.

Centers and programs for wildlife research have been established and funded to provide facts on which efficient management can be based.

At all levels of government much has been done to free wildlife administration from the blight of partisan politics.

Energetic and well-informed citizen organizations are supporting the causes of public interest and ecological management.

Let us hasten to say that more should be accomplished in these fields. More critically, our present report describes issues—some of long standing—on which we have hardly made a constructive start. It may be that the easy solutions, if there were any, have already been applied. The future of wildlife is entangled in the total complexity of man's relationship to nature.

PRINCIPLES AND PREMISES

Decades of this century have witnessed steady gains in useful biological knowledge. Among leadership there is growing sophistication in attitudes toward wildlife and its associated resources. From both science and philosophy we draw assumptions it seems constructive to state:

Each living thing survives and plays some essential part in the

operation of a self-maintaining community of plants and animals. The community and its site, including climate, constitute the ecosystem—the basic working unit of the biosphere.

Habitat is local environment. Its quality determines abundance or scarcity of any species. Habitat improvement is the fundamental need in producing more wildlife.

Man's ecosystem is the entire earth. He must plan its use, protection, and renewal. For the support of all life, its natural processes of rejuvenation and replenishment must continue to operate. This is the great challenge of environmental deterioration.

Man's dependence on living things is a reality of survival. He must be willing to share the earth with other forms of life. Their right to exist should be an acknowledged ethic.

Environmental fitness may be judged by the welfare of many creatures. Regional declines of wildlife indicate maladjustment. They bespeak the need for identification of causes and remedial action.

Governmental or professional responsibility in resource management carries a paramount obligation to the general public interest.

In many useful combinations, soils, waters, vegetation, and animal life are renewable resources—natural wealth and durable systems that can be preserved and improved through a knowledge of life processes. We regard the use of a renewable resource as optimal when it yields the most significant benefits to generations of the present while improving productivity for the future.

WILDLIFE USES AND VALUES

There are satisfactions in human life that have been taken for granted and poorly appraised. Freely enjoyed benefits of the natural environment are notable in this respect. Historically, and particularly among people least familiar with it, wildlife has been an idle cause, easily downgraded or ignored.

The future of such viewpoints is uncertain. People will continue to concentrate in cities. The habits and demands of many will be adjusted to artificial surroundings. Will an increasing proportion of them be deprived of nature-oriented interests? Or will the complexity of their lives cause a turning to outdoor pursuits?

This committee proposes that wildlife has an important place in the kind of living standard Americans should strive to preserve. Its values are of several kinds, and their social significance should grow in times ahead.

Living environment

Since early in the century, professionals have recognized that the esthetic, "nonconsumptive" enjoyment of wildlife in the out-of-doors is by far the greatest value of this resource. There are creature inhabitants in dooryards, city openings, farms, and hinterlands, and in every kind of water area. They lend essential character to our human habitats.

As the ideas of beautification and open space get more attention, the wildlife of urban areas assumes particular importance for its environmental and casual uses. The basic requirement is habitat, and the way of the future is shown impressively in certain cities of North America. Ottawa's surrounding greenbelt, the waterfront parks of Minneapolis, the Chicago Forest Preserve, and Rock Creek Park in Washington are famous examples.

Surveys indicate that bird watchers and nature photographers are about as numerous as hunters, and they spend more time afield. Memberships in nature and conservation organizations continue to increase. Environmental interest is at an all-time high and growing. This universal worth of wildlife to people defies measurement.

Similarly incalculable, and even more basic, is wildlife's biological role. Each living thing of the community has a function that affects all the others. Often we see specific interactions in terms of human interests, such as the abatement of insect pests by songbirds or the suppression of crop-damaging rodents by predators.

But more subtle processes are at work. Many kinds of organisms help maintain the living system of the soil. Animals distribute seeds and do the thinning and disturbing that various species of plants require. Meat-eaters bring the benefits of population control to their prey, and especially prevent destruction of the vegetation food supply.

These relationships are implicit in the survival of ecosystems. They are intrinsic environmental values that benefit us all.

On public lands and waters of every type, wildlife is being used by people with many interests. Often license money and taxes on firearms, fishing tackle, and other equipment are the only sources of funds for purchase and management. As an outgrowth, state administrative agencies have been oriented mainly toward service to those who support their programs. Frequently, nongame species have had only incidental attention.

A new trend is in progress. Game and fish agencies are getting broader responsibilities as wildlife agencies. Ways are being found to supplement their license-based funding through special taxes and appropriations representing contributions of the general public. The

urban dweller should expect that substantial amounts of these funds will be spent on the species that help bring open spaces to life in our areas of high human density. This is the pattern an enlarged program of public wildlife services can be expected to follow in the future.

Field Sports

Since primitive times, certain animal species have been important for fishing and hunting. Such pursuits still provide subsistence to a few native Americans, but for the bulk of the population they represent recreation. The eating of fish and game is the final act in savoring an outdoor experience.

These uses of waters and land continue to grow, as surveys by the Fish and Wildlife Service show. The survey of 1970 indicated that people who fish outnumber those who hunt by well over 2 to 1. In the United States there were 36 million who participated "substantially" in one or both activities, approximately 18 percent of the total population.

The rate of increase in fishing and hunting may level off in decades ahead as a result of several factors:

Continued urbanization of the population.

The ever-greater difficulty of finding open waters and lands.

A growing scarcity of high-quality sport.

The concentration of fishermen and hunters.

Increasing interest in other forms of recreation.

In economic terms, fishermen and hunters contribute substantially to outdoor recreation industries and to public management agencies. Their expenditures in the field during 1970 were more than $7 billion. Their federal excise tax totalled nearly $47 million and their state license fees $192 million. As a taxpayer, the sportsman also has his share in all general levies for conservation and management. We endorse license fees adequate to provide for quality programs of fishing and hunting under conditions that protect the many other outdoor interests of the public.

Commercial uses

The harvesting of some kinds of wildlife for the market has continued since earliest times. Today our chief concerns in this field are to (1) eliminte commercial uses of endangered species, and (2) regulate appropriate commercial harvests to assure a sustained yield and maintenance of the resource.

An annual cropping of wild furs was once the primary industry of North America. That has undergone a long decline accelerated by the development of artificial substitutes. In addition, an ethic is de-

veloping against the wearing of wild furs. The beaver, mainstay of that early fur trade, was nearly wiped out in much of its range. It has now been widely restored by good management in states and provinces. Two oceanic species—the northern fur seal and sea otter—were literally rescued from extinction by timely international agreements.

Major problems are posed by the existence of a world market, as witnessed recently in the case of novelty furs. Heavy inroads have been made on many species of cats, especially in tropical countries. Under authority of the Endangered Species Act of 1969, the United States banned importation or sale of wildlife threatened with extinction. We anticipate a further strengthening of this legislation, but it exemplifies the action individual nations can take while effective world conventions are being sought.

The most significant industry marketing wildlife today is the commercial fishery. Its past history has been marked by the failure of responsible agencies to set and enforce harvest limits within the recovery capacity of fish populations. The result has been depletion of important fish resources.

In Canada and the United States, fishery research biologists have established a substantial fund of management information. This will continue, and in decades to come important sport and commercial fisheries will be restored.

Today's major issue is, again, an international problem. It concerns the right of nations to control the fisheries on their adjacent continental shelves. Foreign fleets, without incentives for moderation, are over-exploiting stocks of fish on both coasts of North America. We subscribe in principle to a resolution of the American Fisheries Society. This called for a major extension of the zone of national jurisdiction to make possible scientifically controlled cropping of fish and other seafood resources. This protection of local industries will create incentives for intensive management. Mariculture is a promising new industry with great potential for the production of shrimp and pompano in particular.

We must recognize, in addition, the worldwide plight of many kinds of whales. Here, international control of the harvest is urgently needed and much in question. The protection and rational management of all living things in international waters requires a responsible world commission. Unlimited demands for food and the continual development of more efficient harvest gear have the potential for irreversible damage. It could inelude not only exterminations but major changes in the life support system of the oceans.

Of the many uses of wildlife, those producing profits to industry

and monetary gain for individuals are the most difficult to control. Where a commercial harvest is allowed, two rules apply: Regulations must be scientific and impartial. They must be rigidly enforced, both in the field and by the courts.

SURVIVAL: THE GREAT PRIORITY

As stated previously, we anticipate a continuing increase of human population and inroads on resources. The problems of endangered species will become more critical as such conditions develop.

Present expedients to protect and restore our jeopardized wildlife are inadequate—a result of fragmented jurisdictions. A succession of clear and interlocking responsibilities should be established for such species from local, through state or provincial, to federal, and international levels.

This committee urges that a new worldwide perspective be promoted by the nations of North America. It would recognize that all peoples have a common concern for the survival of plants and animals still existing on earth. We regard this as a feature of the right-to-live concept already advanced. In a utilitarian sense, the preservation of species leaves options open for generations to come, who may find unpredictable uses for many organisms.

Various kinds of international negotiations are in progress to facilitate cooperative wildlife management. These efforts should be extended to include worldwide conventions on threatened species, wherever they may be. An international custody is needed now and in the future for living things that decline to the point where extermination is possible.

This would have value of a particular kind in the United States. The Federal Government has received jurisdiction over many species of birds and certain marine mammals through the treaty-making powers of the President. This authority, which is restrictive upon that of states, implements treaties with Canada, Mexico, and Japan. Whether or not it is acquired in this way, a federal sharing of responsibility is needed to assure improved measures for the restoration of diminished "resident" species covered only by state laws.

WILDLIFE IN LAND AND WATER USE

The welfare of wildlife depends on what happens to its habitats. Thus its future should be planned in a framework of policies for land and water. In the not-distant future, we may expect congressional action on a comprehensive national land-use plan. We urge that such a plan for the United States embody several features of far-reaching significance:

The third of our area that is public property should remain so. It is the estate of many generations, to which values will steadily accrue.

The remaining public domain should be managed with greater attention to its multiple benefits, including recreation.

A national zoning of uses should eliminate urban, industrial, or other encroachments on fertile soils, prime grazing lands, productive forests, flood-prone areas, and a wide range of aquatic sites.

Great scenery and our declining natural environments should have protection from impinging uses.

In planning ahead, we must assume that basic decisions along these lines will be made in the public interest. They will open important opportunities to improve the status of wildlife.

Agricultural lands

In a recent 17-year period, American farms declined in number by two and one-half million, acres harvested declined by 34 million, farm employment declined by 5 million, and the yield of crops increased by 37 percent! Since the wildlife policy report of 1930, the tractor has replaced the horse and released more than 60 million acres from the production of feed. At least an equal acreage is now withdrawn annually to reduce the production of surplus crops.

These changes affect wildlife both favorably and adversely. On farmland wildlife is largely a by-product, and its status is tied closely to economics and the intensity of land use.

Big-business farming: In regions characterized by extensive, continuous areas of highly productive cropland, agriculture has become a specialized industry. The cropping pattern features, literally, square miles of monocultures—commonly corn, sorghum, wheat, soybeans, or cotton—worked by costly equipment. Heavy use of fertilizers and pesticides is the rule. Land leveling, drainage, cover removal, and extensive fallowing or fall plowing produce a landscape almost totally wanting in the habitat diversity needed by most birds and mammals.

On the fringes of such regions, or where uncleared stream bottoms intrude, grain and hay fields contribute to the production of pheasants and other wildlife; they may be valuable feeding areas for migratory waterfowl. But in the face of high cash-crop values, no general recommendations can be made for devoting space to the cover that is the most obvious habitat deficiency for many kinds of wildlife. As they are at present, the most valuable agricultural soils of the continent are largely unavailable for the management and use of wildlife.

The future of the great monocultures is uncertain, since they are ecologically vulnerable. There are signs that crop interspersion may have values in the biological control of pests. Rotations may be necessary to the long-term maintenance of soils. Lands withdrawn from cropping certainly would have greater public value if seeded to vegetation serving the range of conservation needs. There may yet develop a land-use design more favorable to wildlife, and management authorities should be prepared to take advantage of it.

Diversified farming: Fertile soils have long been recognized as having high potential yield of living things. Extensive conversion of the eastern deciduous forest into farmland favored the spread and increase of many birds and mammals, including those Leopold called "farm game." The same process reduced big game and other creatures requiring large woodlands.

During the thirties, the Soil Conservation Service began promotion of their conservation farming system, which has been particularly significant to wildlife in regions of irregular topography. Individual farm and ranch plans provide for cropping according to land capability through contour farming. The system involves strip-cropping, stubble mulching, and other practices, and it produces edges and a mixture of vegetation types that favor most farm wildlife species. The needs of erosion control result in managed problem areas and uncultivated sites. On these, perennial wildlife cover can be planted or allowed to grow through natural succession.

The bulk of our farmlands grow a diversity of crops. With the land-use plan as a basis, an owner can manage wildlife as intensively as he wishes. Plantings of shrubs and conifers can be used on sites appropriate for hedges, windbreaks, field borders, and "odd area" coverts. On most farms operated for profit, the best policy for a farmer is to allow natural woody cover to become established and to tolerate it where it is not in his way. Wildlife management and beautification are issues of growing importance on the small "residence" farms of city workers. In nearly all rural areas much more could be done to improve habitat and to make wildlife more useful to people. A greater promotion effort—one that would bring farmers the help of true expertise in this field—would pay major dividends if carried out cooperatively by wildlife and agricultural agencies of states and the Federal Government.

Our outstanding example of the manner in which a wildlife management practice can catch on is represented by the two million farm ponds on private lands of the United States. This program has even greater potential for the future, as additional ponds are built and regional fish management methods are refined. The landscaping

of pond sites for homestead values and wildlife cover has been generally neglected and offers state agencies excellent possibilities for developing working relationships with farmers.

Challenges in farm-wildlife management: Urgent problems in agricultural lands demand more research, technical assistance, legislation, and administrative attention. They involve both resident and migratory species. Solutions frequently will require cooperation among several agencies:

Trespass control. Good game lands attract hunters. With a few of those hunters come illegal entry and property damage. We should build on the important pioneering work in some states to develop more effective cooperatives and regionally adapted plans for protecting the rights of landowners in heavily populated areas.

Incentives for managing wildlife. Attractive means of compensating farmers for habitat improvement are needed. Practices beneficial to wildlife should qualify in agricultural subsidy programs, where they have achieved only slow recognition. Wildlife cover and food plantings, specified by biologists, should be incorporated into planning for land and water areas retired or set aside from cropping.

The plans of soil conservation districts and watershed programs need greater input by state biologists and wildlife extension specialists. On farms wildlife habitat development integrates naturally with erosion control and beautification practices.

Damage to field crops. Wildlife administrative agencies must assume greater responsibility in the form of technical aid, material support, and insurance programs.

Forest and Range

In 50 states there are 754 million acres of forest land, of which two-thirds is available for the harvest of wood products. Of these commercial forests 136 million acres are in public and 364 million in private ownership. In the contiguous states, 69 forest or forest-grassland types are recognized. This great segment of the national out-of-doors supports wildlife in wide variety. It receives increasing recognition as a reserve of recreational open space. Management for multiple uses has made a good start in national and state forests. However, properly balanced land management is an objective that must be pursued far into the future.

Of public grazing lands in the United States—some 243 million acres—about three-fourths is administered by the Bureau of Land Management as unallocated Public Domain. Use of these lands is still largely under the domination of local stock-raising interests. Within

its responsibilities the bureau has made significant progress, but recreation and wildlife management need much more attention on these public properties. The program requires greater agency authority and funding, which we strongly advocate.

Wildlife in the Cutting Cycle: Timber harvest creates openings and sets plant succession back to ground vegetation and brush stages. In many forest types these pioneer associations are essential habitat for wildlife. In degree, opening the tree canopy leaves conditions comparable to those produced by such natural disturbances as fire, wind, and avalanche. All stages of growth are used by some species of birds and mammals. A frequent requirement is for a combination of several stages—the intermixture that means productive edges. Sometimes these conditions are present in mature forest, notably in certain northern types, where open stands of conifers develop a vigorous understory. There are places where cutting is disadvantageous to wildlife.

At issue in the management of timber and forage is stability of the watershed. Obviously this is critical to the water-yield value. In addition, marshes, ponds, and beaver works in every stage are habitat for many creatures. The viability of streams is greatly dependent on adequate forest and ground cover. Stream destruction also takes other forms, such as mining for gravel or gold, or clogging with slash.

The management of timber, grazing, wildlife, and people requires an integrated plan for individual forests. Cutting practices have been controversial, and experimentation must continue. Common needs of wildlife suggest the direction of management in appropriate woodland types:

Any clearcuts should be small.

A good mixture of age classes and species is desirable.

Fruit- and mast-bearing trees and shrubs should be retained in stand improvement.

Good hollow trees should not be destroyed.

A border of trees should be left along waterways, and streambeds should be undisturbed.

Piled cuttings should be left unburned.

Fire in Forests and Grasslands: Wild fires can be hugely wasteful. But planned burning is essential to the maintenance of certain habitats and to the wildlife they support. Research has shown the need for prescribed surface fires in perpetuating many conifer types—including areas in designated wilderness. In these we court disaster by fire suppression for long periods. Instead, frequent "gentle" burnings in imitation of the natural pattern must be a part of management.

Fires played an essential role in preserving most of our primitive grasslands. Where natural grasslands are to be maintained—including all types of prairie—burning usually is required to retard woody plant invasions and rejuvenate native grasses. It should be generally recognized that properly controlled burning is essential technology in managing many kinds of vegetation and the wildlife that depends on them.

Wildlife and Grazing: Historically, around the world, natural vegetation pastured by livestock has been overused and depleted. In North America this condition is being improved as private owners profit from technical assistance and as public agencies get more authority and backing in meeting their broad responsibilities.

Our problems have been particularly acute on arid rangelands, where carrying capacity for livestock has often been overestimated. Rates of stocking, established by tradition or legal allotment, have been gradually reduced, but not enough to prevent substantial deterioration of the range. Widlife habitats have been depleted correspondingly. Strong corrective legislation and administrative action are needed.

There are large areas of the Southwest that should not be grazed at all. Originally these lands varied from desert shrub to grassy savanna, and some have been converted by heavy grazing to impoverished brush country. Often their production of livestock is insignificant, but the potential for wildlife and recreation may be much greater. Well situated private owners are realizing good returns from the sale of hunting privileges, and on public lands many kinds of outdoor uses are increasing. More intensive management can enhance these values while restoring lost quality to vegetation and soils.

Well-managed natural rangelands are productive of wildlife—often more productive than grass-brush associations untouched by livestock. Small animal life requires a winter carry-over of adequate cover and seed-bearing plants. Proper rates of stocking by domestic animals and big game will produce more animals per unit than if either were used alone.

On the other hand, wildlife needs particular consideration in land-treatment projects that may result in extensive grass monocultures. The reservation of critical areas from such operations as sagebrush removal can contribute to the interspersion of vegetation types, as will the use of a variety of grasses and shrubs in developing the new range.

Wildlife problems of the western range that have been least satisfactorily handled involve the ecology of rodents and rabbits—their relationship to grazing and to the coyote and other predatory species that feed upon them. Research has made some headway, but

more facts are needed for a new appraisal of the most basic factors in long-term management.

Waters and Wetlands

This report can do no justice to the manifold problems of our continental waters. We take note of three that are great issues of the day or have important wildlife implications for the future:

Pollution: In one form or another, pollution is almost universal. It is the greatest limiting factor to the health of aquatic life. Our penalty in declining fisheries and lost recreation is incalculable.

Most insidious for a wide range of organisms is the accumulation in our waters of many kinds of highly stable toxicants. Agricultural uses of persistent pesticides continue at a high level. We commend efforts now being made to phase out such compounds. Solving world problems of food production or disease control does not require relentlessly carrying on with substandard practices. We must find better ways to accomplish the same objectives.

Like technology and population, pollution often builds at geometric rates. On small waters, inland seas, and world oceans it challenges states and nations to action. We have only begun the huge task of setting standards and finding means of meeting them. The commendable work now in progress must be accelerated in every possible way.

Rivers and Floodplains: The artificializing and overdevelopment of North American river systems are proceeding at an annual cost of hundreds of millions. Yet the damage toll continues to rise in floodplains progressively built up under the encouragement of government policy. As thousands of reservoirs receive their yearly deposit of silt, we add to the huge backlog of economic and hydrologic problems to be faced by generations ahead.

Most of our remaining streams should be left unaltered. Bottomlands should be allowed to perform their natural functions as flood channels and silt-catching overflow lands. Without major investment they can serve usefully as forests, parks, and scenic avenues of wildlife habitat. Far-reaching and basic policy changes are needed.

Wetland Conservation: Marshes, swamps, and wet areas of North America can be described realistically as our most endangered wildlife habitats. A national survey indicated that in primitive times the 48 contiguous states contained 127 million acres of these wetlands and shallow waters. They were a major habitat of migratory waterfowl and local populations of birds and mammals. Coastal wetlands and estuaries are recognized as the indispensable nursery grounds of fin- and shellfish resources. In terms of their yield of living things, these probably are the most productive sites on earth.

Largely within the present century, more than 40 million acres of

the continent's best aquatic habitat has been lost through drainage and flood prevention works. Government subsidies to agricultural programs have been directly responsible for much drainage, ditching of natural stream channels, and destruction of bottomland wildlife cover. The reduction of wetland habitats has reached a critical point, and we recommend several steps as the beginning of a constructive program for the future:

There should be a national moratorium on the payment of subsidies that result in a major loss or degradation of aquatic habitats.

In recognition of the valid interests of landowners and the general public, appropriate means should be found to pay farmers, or provide tax relief in lieu of rent, for the maintenance and restoration of wetland wildlife habitat. This should be a cooperative program utilizing the resources and expertise of agricultural and wildlife agencies at federal, state, and local levels.

Opportunities should be explored for creating or restoring water areas along rights of way of federal and state highway systems and on public lands generally.

Additional wetland units should be established in federal, state, and provincial wildlife refuge systems. In urban parks and greenbelts the development of ponds and marshes can bring spectacular concentrations of waterfowl close to the viewing public during migration seasons.

The rapid deterioration of estuarine resources through pollution and development needs greater state and national recognition. Essential surveys and studies should be intensified and zoning restrictions applied pending the development of long-range plans for protecting and improving these important coastal environments.

This committee commends the adoption by states and provinces of laws to zone and control the use of floodways, riparian lands, and aquatic sites.

Wilderness

This word has various meanings reflecting the values sought by people in relatively unaltered areas of land and water. We support a strong wilderness preservation system, with its many wildlife-related benefits. Wilderness has basic environmental and social values, not all of which can be expected in the same area. Under appropriate conditions these include:

Opportunities for the scientific study of life communities and the processes by which natural ecosystems are renewed. These are the most complex systems of the universe as we know it. Our

knowledge of them is in an embryonic stage, and there is application for all that can be learned.

The preservation of species, especially the perpetuation of natural gene pools unchanged by human uses. Of particular value are completely protected areas large enough to support self-contained populations of native carnivores and the plant-eating animals they must prey upon.

Recreational experiences featuring the primitive scene, solitude, and communion with nature.

In practice it will often be possible to restore a "damaged" wilderness to high standard. Native animals that have disappeared may be reintroduced. The effects of minor grazing or forest cutting can be erased, over time, by plant succession. Fire and other natural disturbances should be allowed to initiate new cycles of plant and animal life, as they did before the coming of modern man. The capacity of life communities to regenerate enlarges the possibilities for wilderness in a wide diversity of environments that should be included in the system.

For all of our wilderness a compromising condition must be accepted: In this age of technology the authenticity of a primordial ecosystem probably can not be total. The presence of environmental contaminants and exotic plants and animals is nearly universal.

For guarding and upgrading the quality of designated wilderness we recommend several policies and practices:

The areas should be blocked in as rapidly as possible through acquisition of privately owned lands.

Back-country recreation areas should be established to relieve the growing pressures on wilderness. We endorse the setting and enforcement of recreational use quotas in classified wilderness.

Incompatible uses, such as grazing, mining, or timber salvage, should be prohibited or phased out at the earliest possible time.

In the administration of wilderness, lands and waters of every kind should be under continuing review to identify qualifying areas, especially in types or regions poorly represented in the system. Rare or endangered ecosystems should have highest priority.

Encompassing the projects and programs that may be undertaken at all levels of government, we recognize three categories of wilderness preservation. For individual areas standards of use and management will need to be effectively publicized:

Primitive ecosystems: We may regard as our "purest" kind of wilderness the rare surviving examples of truly primitive conditions. For the forseeable future these will have premium value for scientific research. Hence, their plant and animal populations should be free of

any consumptive use, including hunting and fishing. Areas of this type can tolerate only light recreational use—commonly observational pursuits permitted by foot-trail access.

Our largest areas of primitive ecosystems are in the national parks and certain northern wildlife refuges. For the future there is need to identify and set aside areas representative of a wide diversity of unique or disappearing environments. Keeping the habitat and wild animal life undisturbed will require a uniform policy and cooperation among agencies.

Recreational wilderness: In the United States the wilderness system established by federal law in 1964 involves the national forests, parks, and wildlife refuges. The law created a procedure for setting aside largely unaltered areas for the preservation of natural features and for recreation. They will commonly be fished and hunted under state regulation. Hunting is damaging to wilderness values if it is accompanied by illegal killing of nongame animals—predators being especially vulnerable. Where necessary, special protection can be given to diminishing species by designating areas where entry is excluded, as has been done in the case of the California condor. Examples of species that will be benefited by large wilderness areas are mountain lions, wolves, grizzly and brown bears, birds of prey, muskoxen, and desert sheep. Coastal sea mammals and birds are in obvious need of more inviolate areas that include their feeding and breeding grounds.

The standards for statutory wilderness are sufficiently broad to accommodate many new areas—some whose quality will improve with time. Lands of the Public Domain, administered by the Bureau of Land Management, were not recognized in the legislation, and these should be eligible for consideration in the system. The time for dedicating wilderness is short. It should be given high priority in our public land management.

Nature preservation: We regard it as particularly important in wilderness conservation that provision be made for setting aside choice small areas, ecological types, and units of wildlife habitat that may not qualify in major categories. Commonly such a unit is preserved as a result of local interest. It may be unique and of national significance, or representative of a primitive type that is disappearing—an uncut woodland, a marsh, swamp, prairie, river canyon, beach, dune, or island. Many of these landmarks have particular wildlife values as the refuge of rare species, or as rookeries, breeding sites, or seasonal concentration points.

This kind of nature preservation can be effective at any level of government or private endeavor. Provincial and state natural area

systems include a wide diversity of ecological types. These constitute an irreplaceable feature of historic preservation programs. The habitat remnants support populations of declining species and communities having esthetic and educational values—even though such significant animals as the buffalo, eagle, and wolf have long been gone.

HUNTING: BIOLOGY AND SOCIOLOGY

Like its predecessor, this report is concerned in part with hunting and game. It is disconcerting to admit that some of the same problems have been carried over, intact or augmented, for more than 40 years. While we speak mainly of hunting, certain aspects of the following discussions apply also to fishing problems.

Anti-hunting Sentiment

An attitude of many people, seeming to grow with urbanization, is the outspoken antipathy to hunting. It regards nearly any killing of wild creatures as destructive and inhumane, although there has been little objection to fishing on this basis. It is evident that different viewpoints, fostered by different definitions of right or wrong, can be highly divisive.

In this case, biological facts are much involved. In productive populations of "resident" wildlife there are compensatory relationships between man-caused and natural mortality—one is not added to the other. Thus, a game crop can be taken under properly adjusted regulations, year after year, without diminishing the population. Among migrant species, less is known of mortality relationships, and the job of regulation is more complex. While errors may occur, means of avoiding them steadily improve.

Agencies administering hunting and fishing are committed to seasons and bag limits that protect the resource. All will agree that the taking of wildlife should employ the least wasteful and most humane methods available.

These facts and criteria are routinely applied in responsible management. They should be understood and considered by anyone who renders judgment of this use of wildlife. However, it is true that hunting sometimes is accompanied by practices we cannot condone on any basis.

Indiscriminate shooting

Public temper is especially short over the killing of nongame animals. For some shooters the season has always been open on birds of prey, species increasingly prized by the nature-oriented public. Any large bird or animal of the roadside has been a likely target.

In deploring these activities, the conservationist habitually weighs words carefully. We emphasize that we are not talking about sportsmen, or even average hunters. We impugn, we say, a hooligan minority of those who bear arms afield. Miscreants who spoil it for everyone.

They do spoil it. Unless far more is done about them soon, public rage could take punitive action against all shooting sports. After 40-odd years of talk, we still know little about the psychology and sociology of the wanton shooter. Corrective action awaits answers to pressing questions:

Is the individual we describe simply an aggressive outdoor slob, the same who cuts fences and tosses beer cans onto the farmer's lawn? If so, what does this explain?

Is he acting through ignorance, because someone has not given him facts in word and picture? Is he managing wildlife according to his own misconception (e.g. about predators)?

Can he be educated? Can he be controlled through any practicable kind of law enforcement?

What is the annual turnover in individual hunters—recruitment of novices and retirements to other pastimes? What does it mean?

Should there be qualifying examinations for hunters, standards of outdoor knowledge and gun-handling skills?

We have not approached these unknowns with the tools of modern social science. They demand intensive research. State wildlife agencies, universities, outdoor and conservation organizations, and allied business interests should take the same constructive part in this issue that they have assumed in other phases of wildlife administration and management.

Society should grant and protect the right of hunters and fishermen to take crops of appropriate species under conditions that do not damage the resource. Society should likewise grant and protect the right of all people to enjoy and benefit from wildlife populations unimpaired by the arbitrary actions of a few. Let no one assume that this is just high-minded theory. Time remaining for effective action is short.

Somewhere and Something to Hunt

Traditionally, hunting as a total experience involves environmental satisfactions: room to roam, quiet, solitude. Hunting at its best cultivates an increasing outdoor sophistication in the individual. He improves his knowledge and enjoyment of nature in all its aspects. He refines his sporting standards, including recognition that quality is poorly measured by the size of the bag.

Free public hunting has been an assumption with American outdoorsmen. In a sense the hunter has been subsidized by the landowner, who produces something that is common property and from which he may profit little, if at all. Yet access to private land will continue to be our great dependence in taking game crops. Maintaining relationshps that will preserve the hunting privilege must be a long-term concern of sportsmen and administrators.

Problems of access are least in regions of low population. They are greatest in our growing metropolitan areas, and the reasons are evident: Although the cities produce many well-informed and well-organized sportsmen, great numbers of urbanites have been isolated from outdoor traditions. Their landowner relationships are poor, and there are too many of them for the available hunting area. The results of such conditions are predictable:

Dissatisfaction with the quality of sport.

Trespass, property damage, and the posting of land.

Law violations.

Pressures for artificial stocking.

In time immediately ahead, it must be assumed that the area potentially available for hunting will be further reduced. In the past decade urban growth has taken three-quarters of a million acres of rural land annually. We must assume also an increase in public demands for hunting and fishing. At any given time it may not be physically possible to meet this demand. Thus, it is defensible policy to strive first for a quality experience for the individual; secondly, we must serve as many people as possible. A number of means are in use, and to be recommended, for increasing hunting opportunities:

The development of cooperatives to organize landowners and sportsmen for the orderly management of hunting.

Access to commercial forest, utility, and watershed lands and waters as a public relations gesture by corporate interests.

Paid shooting preserves and fishing waters. Dependent on the marketing of artificially stocked game birds and fish, these require special regulations and long seasons. Though suitable licensing, their operations can meet state administrative costs of the program.

Gun clubs and fishing waters maintained for private use. These help meet a part of the total need and should have favorable provisions.

Farms and ranches managed for wildlife and the sale of hunting privileges, often with camping facilities and various services available. Private management of big game, upland birds, and waterfowl has made good progress and should receive technical aid.

Through Federal Aid and other funding sources, active acquisition programs should continue to make more state-owned lands and waters available for recreational use, including hunting and fishing.

NATURAL VERSUS ARTIFICIAL

We propose as a worthy objective in outdoor programs that conditions be kept as natural as possible. However, there are realities to be faced. In areas of high human densities, hunters and fishermen, frequently disappointed, bring organized pressures for something to shoot or catch. Commonly this means pheasants stocked before the gun or catchable-size fish from the hatchery.

Many states have recognized the high costs and limited benefits of such programs. They have resisted "put-and-take" stocking in favor of "investments" in land and water habitat. But sometimes the public clamor becomes political action and produces a legislative mandate. Artificial stocking is then unavoidable.

Operations of this kind have little relationship to the maintenance of wild game or fish populations, and they should not be carried on at the expense of the average license-buyer. For legislators and administrators, it should be a standing principle that stocking for the gun or rod be supported fully by the collection of fees from those who directly participate.

THE USE OF EXOTICS

Almost on a daily basis, men are transporting plants and animals around the earth and introducing new organisms to old habitats. The character of life communities is unavoidably changing. Specialized native forms lose out as broadly adapted exotics take over. This process is degrading the diversity of the natural world. There is no cure for it, but it should be discouraged and resisted.

The importation and use of exotic plants and animals should be under rigid federal and state control. Attempts to establish new species in the wild should be undertaken only after intensive study, appropriate agreements among agencies concerned, and adequate public information. This applies to transfers of North American races and species to ranges not previously occupied, as well as to introductions from elsewhere in the world. Among biological hazards to native wildlife are those of ecological competition, genetic infiltration, and disease transmission. Plant introductions may degrade wildlife habitats, as certain highly successful aquatics have demonstrated.

Under some conditions the stocking of foreign big game, and

possibly other species, serves useful purposes on private or commercial preserves. Primary requirements in issuing permits for such undertakings should be that:

The introduced animals can be localized.

In case of need, they can be totally removed by known methods.

PREDATORS AND PREY

Administrative and public viewpoints on meat-eating birds and mammals have changed slowly but steadily since early in the century. The high esthetic value of predatory animals is becoming generally recognized. The predator influence on prey species is necessary to the welfare of life communities. The functions are basic: population limitation and the protection of plant food resources; disease control; the culling of least vigorous individuals.

Probably no relationships in nature are subject to unconditional generalizing. But management concepts and policies concerned with predators appear to be developing along lines that can be recommended:

Indiscriminate predator control, applying to species or entire populations, is unwarranted. Bounty payments are wasteful, and seldom, if ever, accomplish anything useful.

Predators have a desirable selective influence in the annual turnover of prey populations. There are long-range objections to managing any game species entirely with the gun.

Predator problems usually are local and temporary. Other forms of wildlife need no general protection from their natural enemies.

Where plentiful predators are hunted, they should have game status for licensing and regulation.

Scarce or declining predators should have legal protection effectively enforced. In cases of property damage, an alternative to eradication should be sought. Possibilities are compensation for damage, or the removal of predators alive for stocking elsewhere.

Predator Control for Livestock Protection

Historically, in the United States the control of wild predators to protect domestic animals has been a cooperative federal-state effort. This is likely to continue. In Canada the several provinces have had independent programs, which are developing common features as new information is applied.

Particularly in the western states, predator control policies and operations are undergoing changes that will make them more acceptable to a public that has become keenly conscious of predator values.

Features to be recommended in programs and relationships have become evident, and these should be uniformly applied through cooperative agreements between state and federal agencies:

A basic research program—predominantly a federal function—should establish a fund of information on (1) land-use relationships to rodent and lagomorph populations and the predators that feed on them; (2) the extent of livestock depredations by predators; and (3) the improvement of acceptable control measures to meet verified needs.

The funding of predator management and control should be entirely through federal or state appropriations.

Predator control in the field should be discriminate and minimal, featuring technical self-help aid to landowners, or be carried out by professionals with broad wildlife management training.

Poisoning should be outlawed except for emergency use by qualified personnel.

REGULATORY AND ADMINISTRATIVE PROBLEMS

Useful regulatory innovations have appeared in many states and provinces. We cite, in particular, some that deal with widespread problems or have value in controlling activities regarded by landowners and the public as important abuses.

Vehicles

In the regulation of hunting, the principle of "fair chase" should have legal support. The pursuit, spotting, or killing of wild animals from a motor-driven conveyance, including snow machines, boats, and aircraft, should be prohibited. For the protection of natural values, authority should exist for the administrative control of air traffic by public land management agencies.

On public areas there is no such thing as a legitimate "off-trail" vehicle. Recreational vehicles can be accommodated at appropriate seasons by special trails and by regulations that protect rights of the general public. Noisy or misused vehicles and boats should be excluded from public lands and waters.

Guns

Laws in effect in some states requiring guns to be transported on public property cased or in the trunk of a car are recommended. This requirement is complementary to regulations prohibiting shooting from or near public thoroughfares.

Trespass

In most regions of private land, access by written permission has advantages for the legal hunter and landowner. In permitting access for recreational purposes, the landowner should have statutory liability protection.

Law enforcement

Because of the inadequacy of laws, conservation officers often perform their duties at a substantial risk of personal harm and liability. The legal structure under which officers operate should be periodically reviewed and updated by legislative action. Consideration should be given to broadening the police powers of officers, especially where this could be of aid to landowners.

Regulatory authority

The adoption of effective annual regulations by state wildlife agencies requires flexibility and ready access to technical information. This is accomplished to best advantage when broad discretionary authority is vested in responsible administrators.

The policy function

Policies for the management of natural resources are most useful when formulated in anticipation of need by citizen boards and commissions. They are indispensable to both legislators and administrators in defense of the public interest against ill-considered pressures.

Jurisdictions

As a worthy outlook for the future, this committee suggests that state and federal agencies could well be less preoccupied with guarding ther spheres of jursdiction and more attentive to opportunities for cooperation in serving their common causes.

FACTS FOR THE FUTURE

Wildlife policy and operations must be served by sustained and technically sophisticated research. This function is producing well in federal and state agencies and in universities, often carried out on a cooperative basis. Modern research brings together specialists from several disciplines, as needed, to deal with problems in the complex field of environmental science.

The long-standing mission of wildlife research has been to build an understanding of life communities that will contribute to the solution

of a wide array of management problems. A good beginning has been made, but it probably is true that only now are we applying truly modern quantitative methods to unlocking the mysteries of living systems. This work will continue profitably as far ahead as anyone can see.

Our most neglected and crucial research needs are those concerning human social behavior. We have noted the problems of the indiscriminate shooter, the trespasser, and the law violator. We have long bewailed our inability to "reach" the general public with facts and create a better understanding of sensitive management issues. We do not yet know the limitations of human densities in outdoor programs. Or how to serve best the long-term interest of the people in decisions of quantity versus quality.

The biologist alone, the social scientist alone, the economist alone cannot deal with these questions. Their combined effort is required, and it must do great things.

PUBLIC RELATIONS AND EDUCATION

This field has been characterized by thinly spread support and minimum services. Its possibilities are closely related to the sociological investigations we have mentioned.

Extension services to the landowner are essential if we are to have his sympathetic interest in cultivating the private and public values of wildlife. While progress has been made, this work is under-funded or ignored in many states.

The information function must deal effectively with citizen organizations, who need program guidance and encouragement to assume their logical role in resource issues of the state and nation.

Federal and state wildlife agencies should have highly professional news and publication staffs. Newsletters, magazines, bulletins, and books have their place in an imaginative and effective public information effort. Movie-making, radio, and television have shown their worth in scattered examples of superior accomplishment.

The related functions of public information and education have a vital part in making and carrying out natural resource policies. They have long since risen above the role of apologizing for administrative blunders. Representatives of wildlife agencies should serve on planning boards along with engineers, economists, and lawyers.

Wildlife and conservation curricula in the universities are training more undergraduates than the present employment market can absorb. This situation will improve as more states upgrade standards and require a college degree for law enforcement officers. In both

Canada and the United States employment opportunities for students with graduate degrees have been good, and future needs for basically trained professionals should increase.

Aside from professional training, there is a significant student interest in wildlife and natural resources education. These academic programs are well rounded and especially relevant to the needs of citizens in decades ahead. As a still broader campus service, such a course of study should include offerings in human ecology designed to attract students in non-biological fields.

We strongly endorse environmental education of many kinds in the schools. Teacher training in ecological subjects has lagged far behind minimum requirements if we are to achieve basic goals in human welfare. There is around us abundant testimony that the environmental crisis of today and tomorrow must be met in the minds of children. There is no greater challenge of our time.

OUR THOUGHT

We consider it appropriate to end this report with a statement of our hope and belief for the future:

Mankind emerged from the natural order; we must continue to live as part of it. We have but one earth, our home, our keep, our borrowed estate. We must accept the charge, at whatever cost, to maintain its abundance and guard its quality.

We seek understanding of other living things as the way to an enlightened husbandry of man himself.

We see a future that threatens the idle, the ignorant, the improvident. But we see also, in times ahead, the promise of a good life, if men with wisdom and humility will work for it.

THE COMMITTEE ON NORTH AMERICAN WILDLIFE POLICY

Durward L. Allen, *Chairman*
Daniel A. Poole, *Secretary*

Enrique Beltran—Mexico
Eugene F. Bossenmaier—Manitoba
James W. Brooks—Alaska
Charles H. Callison—New York
Kenneth D. Carlander—Iowa
Archibald B. Cowan—Michigan
Henry A. Hansen—Alaska
John C. Hendee—Washington
Cyril Kabat—Wisconsin
Roy Komarek—Florida
John V. Krutilla—Washington, D. C.
Daniel L. Leedy—Maryland
Harvey K. Nelson—North Dakota
Margaret Owings—California
Merrill L. Petoskey—Michigan
Robert L. Salter—Idaho
Samual P. Shaw—Pennsylvania
Clarence M. Tarzwell—Rhode Island
James G. Teer—Texas
Frederic H. Wagner—Utah

HONORARY MEMBERS

Stanley A. Cain—California
E. L. Cheatum—Georgia
C. H. D. Clarke—Ontario
Clarence Cottam—Texas
Lawrence V. Compton—Washington, D. C.
Ira N. Gabrielson—Virginia
Leslie L. Glasgow—Louisiana
Seth Gordon—California
C. R. Gutermuth—Washington, D. C.
A. Starker Leopold—California
Spencer H. Smith—Washington, D. C.
John S. Tener—Ontario
Hoyes Lloyd—Ontario

DISCUSSION

PROFESSOR ALLEN: This has been a hard-working committee. I thank them for their wonderful help and their patience and forbearance in dealing with me.

CHAIRMAN LEONARD: Thank you very much, Professor Allen, and many thanks also to the distinguished membership of your committee.

Enunciation of a proposed new policy is bound to arouse controversy no matter how general the language. However, if the policy were not debatable, it would hardly be required. Complete consensus is not to be expected but significantly divergent views deserve an airing.

MR. WALTER B. SMALLEY: You know, we had a minor confrontation some time back, and I do want to congratulate Dr. Allen on a wonderful paper.

MR. JOHN MCKEAN (Oregon): I appreciate the fact, of course, that many generalities of this type are bound to offend someone. I am sure that many of the things presented in this report would not, for example, be acceptable in our state.

I would like to select one that has been particularly offensive from our standpoint and this has to do with wildlife agency compensation for damage by wildlife to private property. This would be in the form of an insurance program and in the form of outright compensation for damage.

Now, to me, this is a violation of the longstanding concept of wildlife habitat all over the nation and is a concept that could conceivably put all wildlife in great jeopardy. All wildlife consumes something of the land and therefore, to some degree, creates damage.

I would like therefore, to know the origin and the thought of the committee in coming to this policy.

PROFESSOR ALLEN: Possibly there are some other members of the committee who would like to speak to this. I don't want to take the entire responsibility.

Now, insofar as insurance programs are concerned, there is, as you know, background on this and they are being used, primarily in the provinces of Canada. However, I agree with you that, in general, we cannot go into damage compensation on a big scale. I would have no thought of that. However, this is an area that needs much careful study to find less objectionable alternatives.

In the case of endangered species, I believe that private interests frequently are willing to pay damage claims as an alternative to removing the few remaining specimens of an endangered species, and I know of a place where this is being done right now. However, there is not any thought of suggesting that you squander your hard-earned license money on things of this kind because it disappears and there is nothing to show for it. However, these problems do need extensive study and some compensation might be necessary under some conditions.

I am not avoiding the issue. We did not intend to suggest to anyone that this be a large-scale program.

MR. KEITH HAY: First of all I would like to commend you for this excellent policy. I know it took a lot of work and thought. Certainly, the American hunter has been spoiled in the past by an abundance of areas in which to hunt and a lack of restrictions. As has been pointed out, that is going to change in the future.

You did say you wanted to retain quality hunting experiences. I think the policy

should include more on the development of quality hunters for quality hunting experiences and I was privileged to meet some quality hunters recently in Germany. They had to study over a hundred hours in order to be entitled to pay a hunting fee there—not only in training in the use of firearms but also training on game identification and the life histories of the animals that they were going to hunt. I believe the policy should include some measures and steps and provisions for developing a better quality hunter in the future.

DR. BRUCE WILKINS (Cornell University): I likewise rise to what seems to be a significant omission in the policy statement.

You mentioned some 4 million acres of harvested land shifting out of agriculture in the past 17 years. Much of this has not gone into commercial forage uses. This offers unique opportunity for management of wildlife and fisheries and I wonder if you might comment on the omission.

PROFESSOR ALLEN: Our statement on this is conservative. But we did not leave it out because it was said that the land reserve from cropping would be of greater use if seeded in vegetation that serves the broad range of conservation needs, and this certainly includes wildlife.

We also said that wildlife habitat development should qualify under the subsidy programs. We agree with you on that. Certainly these lands should be used to the fullest advantage, especially while they are not being cropped, to grow the kind of vegetation in any given period that will serve wildlife and soil conservation needs also.

Have I answered your question?

DR. WILKINS: No, I don't think you did. I am not talking about individual lands being acquired for uses other than economic return. Further, this excess acreage certainly involves one more rapidly growing use of land in our country. In other words, I am talking about land retired under the cropland adjustments. It is a very significant area and one we should be clear and specifically identify in such a policy statement.

PROFESSOR ALLEN: In relation to the small residence farms that we see springing up far and wide, we have a statement in the draft on that. We recognize that these owners are particularly interested in beautification, landscaping and wildlife and this all ties together. We have recognized, in several places in the report, the need for additional agencies to work with landowners in an extension of this and in a technical help basis. We would agree 100 percent on that and I think it is a great area for better education for all.

MR. R. FRANKLIN DUGAN (Soil Conservation Service, Virginia): I would like to speak briefly on the subject of paying for damages.

I think that perhaps the report could give a little more emphasis to the problem of increased posting of land. We still need to recognize the fact that from 75 to 80 percent of our game is harvested on private lands and as landowners become more and more dissatisfied with hunting damages as well as damages from game animals, we need to face up to this increased posting as a response to this dissatisfaction. In Virginia, a number of counties are authorized by law to charge damage stamps to hunters for hunting certain species of game. The returns from the sale of these damage stamps are then earmarked for paying legitimate damage claims by land owners. Over the past fifteen to twenty years these returns have been more than adequate to pay legitimate claims, and claims for damages have, as a result, gone down due to this program. Also, there is money accumulated in this fund which is then earmarked for various wildlife management practices.

CHAIRMAN LEONARD: You know, we must expect to learn from experience. While I am not a member of the committee and cannot presume for them, I am sure it is not their thought to dictate methods in which responsible agencies would attempt to solve problems which the committee has pinpointed.

To me, one of the encouraging things about this conference has been the conspicuous and very fruitful contribution of social scientists considering human aspects of the problems which many of us biologists have too often considered exclusively wildlife problems.

MR. DOUGLAS SCOTT: Probably our greatest issues in wildlife management in the last five years have been the introduction of deer, wild turkey and beaver to some of these lands where they formerly occurred. These introductions were primarily due to changing land uses, which came about as a result of the economic situation. Our present problems, such as lost wetlands, predator control, overgrazing, strip mining, all of these things, are the fruits of the economic situation which has resulted primarily from political decisions.

I think we have some very good people in The Wildlife Society and other conservation agencies that are actively working in government, trying to show our viewpoint, trying to persuade legislators to get these things changed more to our liking.

However, I think the real boost we need is to emphasize game management at a person-to-person level and through various publications. Further, it would help if many of these people would get out and meet more of the general public and put across our point of view. These people are the only ones who can vote in some of the programs we need.

The legislators every day have special interest groups trying to persuade them and, as such, they are going to listen to us. However, they may not necessarily be thoroughly convinced because we are a special interest. On the other hand, if we can get the general public to back us up through an information and education program, we can then, in turn, solve some of these problems.

We should emphasize this aspect more than anything else in terms of the large-scale problems we have today.

DR. DOUGLAS PIMLOTT (University of Toronto): I would like to speak from my role as president of the Federation and perhaps I can shorten the gap that exists between hunters, ecologists, and naturalists. I would like to refer to the particular section of the report dealing with hunting and with anti-hunting sentiment.

My feeling, perhaps, about the report, is that it deals in too traditional ways with some aspects of this question and does not recognize some of the very subtle elements that are rather important in relation to the whole question of anti-hunting sentiment.

In terms of naturalists, preservationists or whatever you choose to call them, there are certain things that are never going to come across as a result of public relations programs. For example, the degree to which hunting will be permitted on endangered or rare species which come close to those categories.

If you take a species like the cougar, which people are generally coming to think of as being endangered, at least in parts of North America, you may have a very difficult problem indeed in curbing anti-hunting sentiment when people see that animal being hunted. This is regardless of whether or not this was a rational thing to do. Therefore, in relation to this thesis, it is very important to consider what are the subtleties involved and professionals—particularly the professionals in management who have long been in tune to this situation—must think a lot more about these subtle aspects because they will influence the whole area of anti-hunting sentiment and there is very little that can be done to overcome it except by some new approach.

In cases where predators are involved, there are some entirely new methods of control that may be needed—in which, for example, there is a form of citizen committee interaction involving and supervising policy. However, I would suggest that a part of our approach to new policy should indicate that we be much more cognizant of these subtleties, which will tend to dominate consideration of the preservationists in the future.

CHAIRMAN LEONARD: Thank you for your voluntary observation.

PROFESSOR B. L. DRIVER (University of Michigan): I am an outsider to the Institute and the Society and maybe, therefore, I can make some outside comments.

It is appropriate that the policy statement does focus on resources. It is understandably appropriate but, on the other hand, I am personally disappointed it did not warrant some other factors, specifically, as an outsider, someone more

interested in the social science realm, some of these statements came through—for example, environmental education and the urbanization concept—more as a lip service than as a delineated, articulated policy statement. I tend to be frank and, therefore, excuse me if I misread something.

Specifically, the statement on environmental education, I thought, had been elaborated on considerably with respect to possibilities of wildlife managers and resource professional having this as an important area.

The whole interface between wildlife management and urbanization was neglected. It is a little disappointing to me that ecologists do not perceive and articulate this a little better and, finally, the whole area of minority subcultures was ignored. Now, I don't know what the membership in your professional society as to blacks and Indians are, but I would guess that there are less than twenty, as there are in the forestry profession which I am associated with. I think we are really interested in serving people and meeting needs and increasing satisfactions and relating wildlife to people, particularly those who manage wildlife. There is a tremendous opportunity here for the Institute and society to help move minority people through the professional fields.

With these few comments, I would like to express my general appreciation for the highly articulate panelists who discussed the planning situation and to Dr. Allen and his distinguished associates for preparing the new North American Wildlife Policy.

CHAIRMAN LEONARD: And with those comments, we will now stand adjourned.

* * *

Human Dimensions in Wildlife Programs

March 19, 20, 1973

Co-Chairmen

JOHN C. HENDEE
Recreation Project Leader, U. S. Forest Service,
Seattle, Washington

and

CLAY SCHOENFELD
Joint Professor of Journalism and Wildlife Ecology
and Chairman of the Center for Environmental
Communications and Education, University of
Wisconsin, Madison.

The following section comprises papers from two related sessions—the regular afternoon technical session on Monday, March 19 and a special workshop held on Tuesday afternoon, March 20

Ed.

DEFINING AND EVALUATING RECREATION QUALITY

DANIEL R. TALHELM
Resource Economist, Office of Planning Services, Michigan Department of Natural Resources, Lansing, Michigan

Sociologists and economists have much in common in investigating the benefits people derive from wildlife resources. Both can contribute much toward improving management for the benefit of hunters and other wildlife users. Perhaps the most important difference between the two is that sociologists focus upon the social-perceptual processes by which wildlife utilization becomes human satisfactions or benefits, whereas economists focus upon the ways user exchange their time and money resources for wildlife use, assuming that people make such exchanges in proportion to the personal benefits received. In other words, economists observe what people do, and assume that they had a rational reason for doing so, whereas sociologists observe what people do and ask why. As a result, sociologists attempt to measure benefits in terms of satisfactions, and economists attempt to measure benefits in terms of marketable resources, which in turn are measured in terms of dollars.

There is often some difficulty in relating satisfactions to the practical problems of resource allocation, especially since optimal resource allocation requires comparing both the benefits and costs (or satisfactions and dissatisfactions) of all possible trade-offs in decision-making. Economists have the advantage of measuring resource exchanges people actually make, rather than what they say they would like to make. This permits economists to compare directly the trade-offs people appear to make for their own benefit to the trade-offs that are required for resource management. By providing insights into user behavior, sociology can also greatly improve the information needed for decision making.

This paper explains how, by observing recreation participation patterns, we can determine which attributes of hunting (or other wildlife use) people act as if they find important. Knowing this, a demand analysis can be applied and used with supply information to determine the apparent optimum allocation of management efforts, maximizing the apparent net benefits to society.

This process involves finding the sets of attributes of the recreation that best describe the different varieties, or "characters," of hunting (or other wildlife use). Individuals have differing degrees of preferences for each variety, and those preferences are measured in a demand function for each variety. The demand functions permit calculation of the value to users of many alternative changes in the

attributes of the recreation at various locations, as well as the concurrent shifts in the amounts of use at various locations. Demand functions also (1) provide a preference rating between each pair of characters, based upon estimates of the willingness of hunters or others to substitute one for the other, measuring similarity, inferiority or superiority, or complementarity; and (2) permit calculation of the benefits to users of each character. To the extent that recreation quality is expressed by the degree of preference for recreation with each given set of attributes, the techniques described here measure quality in great detail.

QUALITY, CHARACTER, AND ATTRIBUTES

It is widely recognized that recreation experiences vary in quality. The common concept of quality implies a value judgement between "high quality" and "low quality"; the former being more desirable than the latter. Yet since personal preferences vary, there is not necessarily any consensus as to the attributes of high quality recreation. Even if there were a consensus, how can we judge the relative importance to society of "very good" recreation as opposed to "superb" recreation? Obviously, the notion of quality ratings is not very practicable for resource allocation.

A more useful notion is that different recreation resources have different attributes of diverse importance to users. Nearly any recreation resource (*e.g.*, a park, a trout stream, a given location for hunting), can be characterized by enumerating the attributes of the associated recreation experience that users expect. For example, duck hunting areas might be characterized by the probability of bagging ducks, the species mix of ducks, the crowding conditions, the type of hunting habitat, regulations, the extent to which publicity has influenced expectations, and other such attributes. This would be analogous to describing an automobile in terms of color, size, handling ease, comfort, miles per gallon of gas, and accessories. Each permutation of attributes describes a different "character" of hunting, analogous to the different makes and models of automobiles.

If we consider in detail all of the many attributes of any kind of recreation, the fine details and numerous permutations of attributes soon become overwhelming. For practical purposes, each attribute may be divided into fairly broad levels, such as: high, moderate, or low probability of bagging ducks. The dividing points between high, medium, and low can be precisely quantified (using arbitrary criteria).

The idea is to use the permutations of attributes to define the different characters (or "makes and models") of recreation, in such a way that each character is unique from the user's point of view. It is

not necessary that all users recognize all characters of recreation, just as all automobile users can't recognize all makes and models; but an appreciable number must act as if they perceive some difference, in order for us to detect the selection process.

This brings us to the problem of determining which attributes, or levels of attributes, are important to the users. If we have correctly defined and identified the various characters, few users will have any reason for not going to the closest site of any given character.

When purchasing an automobile, one considers the various makes and models and their prices, then makes his choice. Through a similar process, hunters or others select the most convenient sites having the attributes important to them, considering the availability of sites having other attributes. If a significant number of users forego using the most convenient site of a given character, to use less convenient sites of apparently the same character, that is evidence that the character is incompletely defined: users apparently find something about the less convenient site that is more attractive than the more convenient site. By examining the difference in such cases, or by testing various sets of attributes, the set of attributes most consistent with user behavior may be identified. If a sufficiently large number of alternatives is available for users to choose from, the most consistent attributes will define all of the different characters of recreation that at least some users apparently find important.

Such an analysis could be confounded by at least three factors, two of which could be corrected for. First, users may lack knowledge of the attributes of the various sites, and thus mistakenly go to less advantageous sites. In addition, hunters in particular may know landowners in one location and not others. Second, some users have more than one reason for traveling to a given location, such as participating in more than one kind of recreation. In such a case the more distant site may actually be the more convenient site. Third, sometimes a more distant site is more convenient because one can stay with friends or relatives instead of commercial lodging. The last two problems can be identified through use of the appropriate questionnaire and analyzed separately. The first problem seems inevitable. As a result, the most consistent set of attributes is the set for which the greatest proportion of users go only to the most convenient sites of the various characters.

This was clearly shown in a study of trout anglers in Tennessee (Talhelm 1971).[1] They went almost exclusively to the nearest of two equivalent tailwaters unless they were nearly equidistant, despite the

[1] Tailwaters are rivers immediately downstream from reservoirs.

fact that one or the other was frequently unfishable when its water flow was increased.

DEMAND AND PREFERENCES

The following example from Talhelm, 1971, examines decisions that might be made by trout anglers from a given origin. Similar decisions are apparently made by duck hunters, deer hunters, and most other such groups. Figure 1 illustrates hypothetical locations of several trout stream segments, represented by numerals, in relation to a population center. Some anglers may go to the nearest location where *trout* fishing is available, represented by any of the numerals. Some may go to the nearest location where *high-catch-rate* trout angling is found, represented by "2," "3," "4," or "5." Others might go to the nearest place where high-catch-rate trout angling is found on a *medium size stream,* represented by "3," "4" or "5." Still others will go to the nearest high-catch rate, medium-size stream where *"artificial lures only"* regulations are in effect, represented by "5." Figure 2 illustrates how eight different characters of trout angling were defined. Note that not all possible permutations exist.

Some anglers will go to a location such as one with angling character "5" simply because it is the most convenient place where trout fishing is found. Others who would have been willing to accept what they considered lower quality, such as a lower success rate, find that the "better" angling is the more convenient. By identifying the destinations and participation rates of anglers from each origin, such patterns can be expressed in the form of demand equations.

Demand equations for hunting or other recreation are essentially expressions of the amount of hunting of a given character, as a function of the time and money costs of the character of hunting, the

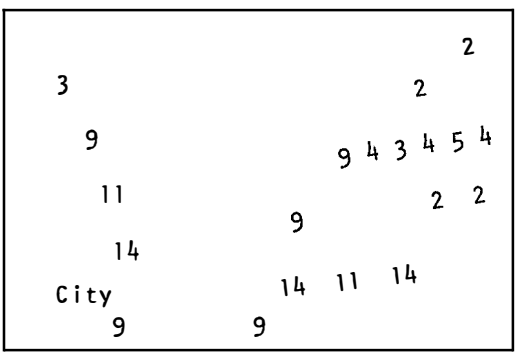


Figure 1.—Hypothetical region with seven different characters of trout angling. Each stream segment is indicated by a number corresponding to the character defined in Figure 2.

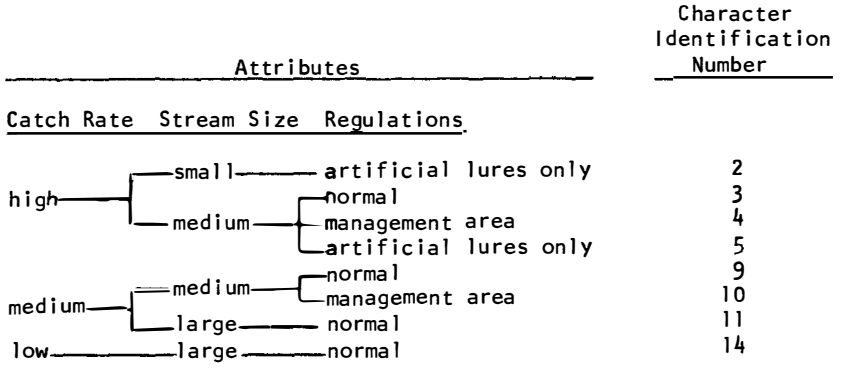


Figure 2.—Diagram defining eight different characters of trout fishing found in the southern Appalachians (from Talhelm, 1971).

time and money costs of other characters of hunting, and related factors. Because time and money costs are measured in terms of dollars, and because dollars are measures of the market goods and services that can be purchased with dollars, the demand equations express the willingness of people to exchange market goods for hunting of given characteristics. They are quantified expressions of hunter preference for given kinds of hunting.

If some hunters are highly willing to use any of several characters, the demand equations for those characters will show that the quantity of use of any of them is high when its price is low and/or when the prices of others are high. In effect, some of the coefficients in the demand equation measure the general willingness of hunters to exchange hunting of one character for others. This "willingness to exchange" will indicate one of three general feelings the hunters may have regarding any pair of characters: (1) similarity—hunters feel they are good substitutes for each other because their preference for the two are roughlyequivalent or because the differences are unimportant, (2) inferiority or superiority—hunters feel one is a preferable form of hunting to the other, or (3) complementarity—the presence of one character enhances the desirability of the other. The strength of these general feelings is indicated by the magnitude of the coefficients.

EMPIRICAL STUDIES

The author has completed two such studies, one of trout angling in the southern Appalachians (Talhelm 1971), and the other of salmon-steelhead angling in Michigan (Talhelm 1973), and is in the process of conducting similar studies of hunting, angling, camping, day use of

state parks, and boating in Michigan. Both references discuss in more detail the analytical techniques and economic theory referred to here.

The trout angling study indicated that catch rate, stream size, and regulations were the most important attributes defining trout angling character in the southern Appalachians. In some cases the number of streamside buildings further defines angling character. Figure 3 illustrates slightly modified demand curves for the eight characters in Figure 2. Each demand curve is drawn assuming the price of all other characters is five dollars, roughly the average price, represented by the horizontal line. Demand is greater the higher the catch rate and the larger the stream size. Characters three, four, and five are all high catch rate angling on medium size streams, but four and five are on specially managed blocks of national forest land, with angling limited to three days a week at one dollar per day. The demand for character five, where angling is restricted to artificial lures only, is greater than three or four at high prices, but is lesser at low prices. Apparently a limited number of anglers strongly prefer this character of angling and are willing to travel great distances or pay high prices for such angling opportunities.

The study of salmon-steelhead angling in Michigan demonstrated that the value of the opportunity for salmon-steelhead angling is about $30,000,000 annually, compared with annual management costs of about $1,600,000. In other words, salmon-steelhead anglers would be willing to pay a maximum of about $30,000,000 per year, in addition to present expenditures, to prevent the complete loss of the opportunity for salmon-steelhead angling in Michigan, assuming that other angling remains unchanged. The characters were defined primarily by combinations of catch rates of three species: coho salmon, chinook salmon, and steelhead trout. Other attributes of importance in some cases were: (1) urban or nonurban angling environment, (2) publicity, (3) early or late salmon migration, (4) the nature of the streams in which the fish migrate, and (5) the availability of complementary types of recreation.

Anglers apparently prefer salmon-steelhead angling with higher catch rates to that with lower catch rates. This is indicated by three factors: (1) the demand is greater for the former, (2) anglers are quite willing to switch from lower-catch-rate angling locations to high-catch-rate locations, but not vice-versa, and (3) a stronger positive relationship between personal income per capita in the angler's origin county and the demand for higher-catch-rate angling.

Since anglers fish jointly for salmon and Great Lakes lake trout for at least part of the year the presence of one was shown to enhance the desirability of angling for the other. Some other conclusions about

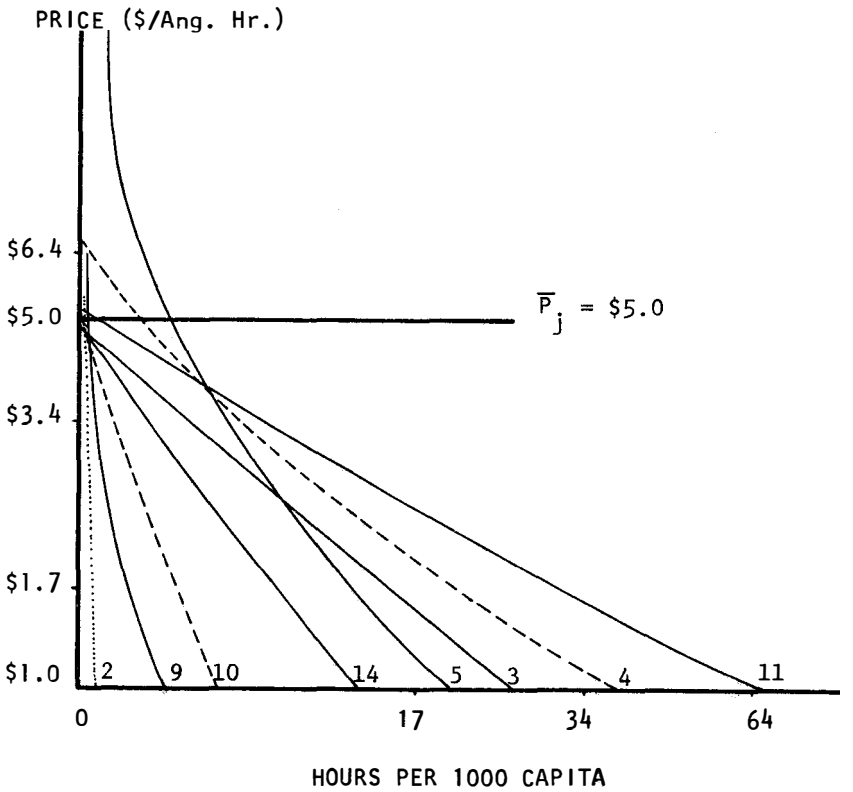


Figure 3.—Demand for various characters of trout angling in Tennessee. Pj is the price of all alternative characters in the equation as illustrated for any singular character.

salmon-steelhead anglers are: (1) they consider inland trout angling as roughly equivalent to salmon-steelhead angling, (2) they strongly prefer high-catch-rate salmon-steelhead angling to other game fish angling (bass, muskellunge, walleye and pike), and (3) even more strongly, they prefer high-catch-rate salmon-steelhead angling to perch-panfish angling, particularly during summer.

APPLICATION TO MANAGEMENT

By using the appropriate simulation techniques, we can estimate: (1) the gain or loss in value to users of changing a trout stream or other resource unit from one character to another, (2) the value loss to users if the resource unit become unavailable, or (3) the value gain to users accompanying the advent of a formerly unavailable resource

unit. For example, the salmon-steelhead study demonstrated that increasing catch rates of salmon or steelhead in some locations would have considerable value to anglers, as would the advent of salmon or steelhead angling near the Detroit area. The changes in the amount of use in each case may also be estimated.

A change in the character at a location could have several effects, caused by the fact that those who prefer the character that was at the location before the change will have to travel farther to another similar location, or quit, or accept a substitute; whereas those who prefer the new character may do the opposite. As a result, some users may have a loss in value, estimated by their willingness to pay to prevent the loss of the old character; and some may have a gain in value, estimated by their willingness to pay to promote the change. This rather complicated set of considerations, explained more thoroughly in Talhelm 1973, includes the relative location of alternative characters and other kinds of recreation, the relative location of the population, the particular costs involved, and the level of demand for the characters involved in the change.

Such a change in character is more typical of changes that actually occur, rather than a complete loss or advent of the resource, and the evaluation procedures should permit a much more accurate assessment of the value of management than other techniques presently in use. Basically, the evaluation procedure described here summarizes the apparent preferences of users in terms of resources, or dollars. These dollar figures can be compared with the value of resources required for management, to determine if user preferences warrant management expenditures or other management activities affecting resource allocation.

CONCLUSIONS

The methodology presented here should prove to be highly useful for planning and management. The methods are relatively simple, yet scientifically rigorous, given an adequate data base and computer technology; and have the potential of being highly relevant to management. Using observations of actual resource allocation decisions made by users, with dollars as a yardstick, the procedures summarize user preferences in a way that is directly applicable to resource allocation.

Perhaps the biggest disadvantages are: (1) root causes are never directly explored, although they are indirectly suggested, and (2) only existing situations can be explored because of the data requirements, although inferences and interpolations may be based upon actual results. Further investigations relating the findings of such a

study to social-perceptual processes could also prove highly useful to management. For example, how do the values as measured in terms of resources by the procedures outlined here, compare with the "satisfactions" that might be measured by sociologists? Other work might investigate whether the attributes and characters identified by these procedures are actually the same as those the users perceive as important, or whether any attributes or characters that do not exist in a study area would be of significant importance to users.

LITERATURE CITED

Talhelm, Daniel R.
1971. Analytical economics of outdoor recreation: a case study of the southern Appalachian trout fishery. Ph.D. Diss. (filed in 1972). North Carolina State University.

———.
1973. Evaluation of the demands for Michigan's salmon and steelhead sport fishery of 1970. In press, Michigan Department of Natural Resources, Lansing.

MOTIVATIONS FOR FISHING

RICHARD C. KNOPF, B. L. DRIVER AND JOHN R. BASSETT[1]
School of Natural Resources, The University of Michigan, Ann Arbor

PURPOSE

The purpose of this paper is to discuss the question of why people engage in fishing and other outdoor recreation activities. This is a fundamental question to the rapidly growing number of researchers and managers who are concerned with learning about the meanings, values, satisfactions and benefits that people attribute to recreation (Lucas 1964; Burch 1965; Hendee *et al.* 1968; Catton 1969; Shafer and Mietz 1969; Witt and Bishop 1970; Clark *et al.* 1971).

The paper is organized into four segments. First, we argue for approaching recreation management problems from a behavioral viewpoint. Second, we identify general forces that we feel are important in influencing how people choose to spend their leisure time. Third, we discuss our progress in developing techniques for identifying and measuring some of the more pervasive and managerially relevant motivations of recreationists. Fourth, we illustrate the use of these techniques to learn what motivates selected groups of fishermen in Michigan. The paper should be considered only a status report because we still have much to learn about measuring motivations and interpreting the results of those measurements.

[1] We gratefully acknowledge financial assistance by the U.S. Forest Service in our research and appreciate the unusually helpful comments of Thomas More on early drafts.

NEED FOR A BEHAVIORAL APPROACH

To establish a conceptual framework within which the behavioral approach to recreation can be evaluated, we find it useful to suggest that recreation planners and managers must consider their problems from four different but related viewpoints. These are identified here as the resource, activity, economic and behavioral approaches. In the resource approach the physical resources themselves strongly influence the kinds and levels of recreation opportunities developed. This approach has sometimes overemphasized supply considerations and slighted demand factors, resulting in the creation of many similar recreation opportunities on a given resource base within a region (Twiss 1970).

In the activity approach, past consumption or participation determines the types of recreational opportunities that are to be provided in the future. This approach has been used widely because high levels of participation have been assumed to indicate "successful" planning. Although a necessary approach, it has two major deficiencies. First, it equates demand with past participation, which makes it difficult to consider latent preferences (Knetsch 1970). Second, it does not identify and measure the outputs of recreation systems beyond counts of users (Driver 1972).

The economic approach deals with at least three kinds of fundamental problems in determining (1) the appropriate role of government in providing recreation services, (2) the efficient level of investment in recreational resource development and the need for better methods of making comparative evaluations of alternatives, and (3) who should pay, when, and how much. Recent increases in participation in outdoor recreation have made it necessary for the economic approach to receive additional attention (Clawson and Knetsch 1966).

The behavioral approach views recreation as an experience. It is concerned with why a person participates, what he does while participating, and what he experiences from that participation. Recreation participation is viewed as a response to some perceived consequences that are desired. System outputs are quantified not only in terms of number of users or use-days but also in terms of the level of satisfactions, *i.e.*, the degree to which recreation opportunities are congruent with user aspirations. Satisfying experiences are the ultimate products.

While planners and managers use all four approaches to solve recreation resource-related problems, we feel that the behavioral approach has been employed too infrequently as a basis for decisions in wildlife and fishery resource management. This is not surprising,

for the conceptual bases of this approach are not fully established, and the necessary empirical documentation has only recently begun to emerge. As one effort to strengthen the behavioral orientation of wildlife and fisheries managers, this paper focuses on research techniques and selected behavioral interpretations of recraetional fishing.

THE FOUNDATION OF RECREATIONAL CHOICE

Why do some people spend their leisure time fishing rather than in some other activity? Does fishing offer them unique opportunities to fulfill preferences that cannot be met either in their everyday living and working environment or in other leisure pursuits? The answers to these questions require an understanding of the determinants of recreation choice. Because recreation choice seems to be influenced strongly by events in the nonrecreational domain, it is necessary first to consider the nature of human activity in general.

An increasingly popular model of human behavior is one that views man as a problem solver (Boulding, 1956; White, 1959; Miller *et al.*, 1960; Howard and Scott, 1965). This approach is gaining acceptance in the social and behavioral sciences because it incorporates dimensions of many other approaches, whether they be socio-dynamic, psychoanalytic, cognitive or behavioristic in orientation. The problem solving model proposes that man has a highly sophisticated ability to gather and process information about his various environments (physical, physiological, psychological and social). As a result, he has a need to know just where he stands within each of them. Therefore, man continually monitors his various environmental situations and decides at some level, whether conscious, unconscious or physiological, if actual environmental conditions agree with preferred conditions. A problem exists when actual conditions do not correspond with preferred conditions. Such problems are accompanied by tensions and by motivating energy that is generated to solve these problems. It should be pointed out that the actual conditions experienced may not be bad or highly undesirable. A problem would exist, for example, if an individual were in a state of bliss but gained information which triggered a preference for an even more blissful state.

Our model of recreation behavior is based on this generic problem solving model of human behavior. Stated simply, the choice of recreation environments and/or activities is strongly influenced by problem states that either cannot be, or for some reasons are not, resolved in nonrecreational environments. The choice might be based primarily on curiosity-exploratory preferences for variety or change, or it could be to realize preferred levels of skills, to collect status symbols, to develop and maintain social affiliations, or to remove one's

self temporarily from adversive work or home environmental conditions.

Our model proposes that, while recreating, people are relatively free to move in a variety of preferred environments that are chosen because of "problems" experienced prior to the time the choices are made. As an extension of the model, we propose that these problem states define relatively unmet needs that influence the direction, intensity and persistence of recreation behavior as these needs are modulated by past learning and by personality, environmental and other static and dynamic influences. If a person is a dominant personality or a high achiever and enjoys plenty of opportunities to meet these needs in his nonrecreational pursuits, the model predicts that these needs are not as influential in determining his choice of recreational activity as are his unmet needs.[2]

IDENTIFYING AND MEASURING MOTIVATIONS

Research on recreation behavior at The University of Michigan has helped form the theoretical bases of this model (Say 1971; Marans 1972; Bassett *et al.* 1972; Knopf 1972; Mandell and Marans 1972; Davis 1973; and Grubb 1973). The general approach has been to attempt to assess various need states that are pervasive in influencing choice of recreation activity.

Over the past four years, we have asked recreationists engaging in different activities to rate the importance of a wide variety of items as reasons for participating in that activity. The items (reasons) used in our questionnaires were generated by other studies and/or by the researchers. Each item was selected to relate to a specific problem state hypothesized to be important in recreation participation. Different formats for the questions have been used employing a modified Likert response scale of the following form:

Reason	*Degree of Importance*				
	Extremely	Very	Moderately	A Little	None
Opportunity to be with people	____	____	____	____	____
Chance to escape noise at home	____	____	____	____	____
Can apply skills	____	____	____	____	____
Like natural sounds and smells	____	____	____	____	____

[2] Our choice of the words "unmet needs" is based on research results that cannot be elaborated here (cf. Knopf 1972). To enhance philosophical clarity, however, we will suggest that man has few needs strictly defined other than those relating to conditions necessary for survival. We prefer a less stringent definition of need and one that includes preferences more generally related to adaptation, adjustment, growth and development, and one that permits appraisal in terms of effective and preferred performance, a commonly accepted measure of mental and physical health and well-being.

To quantify the responses, numbers were assigned each response choice. Different designs have used 5- to 9-point scales. All mean responses reported in this paper are to a 9-point scale on which 1 and 9 represented "not important" and "extremely important," respectively.

In various studies we have administered questionnaires to recreationists participating in over 20 different activities. Responses were subjected to cluster analysis (Kulik *et al.* 1970), a technique similar to factor analysis. This technique allowed us to identify those groups (or clusters) of items that exhibited common patterns of response. Each group is a "scale," which, through use of means, can be used to assess the intensity of a specific motivational state. Each scale is assumed to measure a common motivational dimension. Thus, clusters of achievement-related items are said to measure achievement motivation (or a specific dimension of that need), and clusters of items that describe preferences to see and learn new things are said to measure exploratory motivation, etc.

The only item retained in each scale were those that have (1) intercorrelated with an average Pearson product-moment correlation coefficient (r) of 0.4 or higher, (2) not reduced the internal consistency or Cronbach Alpha (Nunnally 1967) of the scale and (3) contributed toward an overall Alpha value of 0.6 or higher. Also, only those items that clustered together by each of several user characteristics, such as age, sex and party size, were retained in a scale. To increase further the stability and reliability of each scale, additional items were added to the questionnaire in subsequent studies. These augmented groups of items were then cluster-analyzed and screened according to the same criteria. Our 13 current scales each contain more than five items and have average r values of 0.5 to 0.8, and Alpha values of 0.8 or higher (see Knopf 1972).

We feel that we have made substantial progress toward developing scales that represent a broad range of motives relevant to recreation. We currently have scales for achievement, affiliation, exploration, dominance, status, experiencing nature, risk-taking, family togetherness and five different types of stress mediation. Analyses of variance show that 12 types of recreationists score differently on these scales ($p<.01$ for each scale; Knopf 1972).

Results from applying our scales to samples of participants in several different recreational activities, including fishing, suggest that different activities help resolve different "packages" of unmet needs. The remainder of this paper deals with our attempt to identify and evaluate the motives to which fishing appeals.

RESULTS USING OUR TECHNIQUES

We have chosen data from three studies designed to (1) determine why fishermen fish, (2) explore the conflicts in motivations of fishermen and canoeists and (3) illustrate interaction between motivations. Study 1 (Knopf 1972) was directed only at scale development. Ten scales were administered to 12 test groups of about fifty recreationists engaging in different activities, including two types of fishing.[3] The fishermen included only 25 trout fishermen on Michigan's Au Sable River, approximately two hundred miles north of Detroit, and 30 fishermen on lakes in suburban areas near Detroit. In Study 2 (Davis 1973), four scales were administered to 100 participants matched by race (whites and blacks) in each of three activities, including bank fishing, in Belle Isle Park, a recreation area on an island in the heart of Detroit. In Study 3 (Bassett *et al.* 1972), 834 canoeists and 593 trout fishermen were sampled on the Au Sable River in 1971. Scales employed in the latter study are not as reliable as in the first two, but we are sufficiently confident of them to include these additional data here.

Why Fishermen Fish

Study 1 suggests that fishermen are strongly motivated by four unmet needs: temporary escape, achievement, exploration and experiencing natural settings. The need to escape temporarily from stressful conditions in the nonleisure environment, although important in all 12 recreational activities sampled, ranked particularly high (mean of 5.9) for the fishermen. Combined data from Studies 1 and 2 suggest that the closer the fishermen lived to an urban area, the more they needed to escape:

Area and Fishing Activities	*Need to Escape, Mean Score*
Northern Michigan trout fishing	5.8
Suburban Detroit lake fishing	6.0
Belle Isle bank fishing	6.9

Using our scale items, another study found a positive relationship between increased importance of temporary escape (as a reason for engaging in outdoor-recreational activity including fishing) and poor neighborhood quality, which was measured along several dimensions (Mandell and Marans 1972). In that study respondents were asked to judge (on a 5-point scale) the degree of crowdedness and upkeep in their neighborhood. Outdoor recreation activity was rated either

[3] Because our interest was primarily in scale development and because of budgetary constraints, we did not sample randomly and limited our test groups to 50 respondents.

"very" or "moderately" important for temporary escape by 69 and 49 percent of respondents who judged their neighborhood to be "most" or "least" crowded, respectively; and by 65 and 45 percent of respondents who felt that their neighborhood was kept up "poorly" or "well," respectively:

Perceived Quality of Neighborhood	*Importance of Recreation for Temporary Escape*	
	High	*Low*
	—— percent ——	
Most crowded	69	31
Least crowded	49	51
Poorly kept up	65	35
Well Kept up	45	55

Improved scales will help identify additional problem states that precipitate the desire to escape. For now, the most we can say is that many fishermen fish because they desire to escape, and some city dwellers find escape by fishing close to home. Mandell and Marans also showed that "relief of tension" and "temporary escape" were important reasons for engaging in all of the activities they studied.

The opportunity to achieve appears to be an important motive for fishing (means of 4.6, 4.7 and 4.9 for inland lake, trout and Belle Isle bank fishing, respectively), yet it seems even more important to many other types of recreationists studied, notably tennis players (6.7), trail bikers (5.7), sailboaters (5.7) and golfers (5.5). In the Belle Isle study, fishermen with annual incomes of $8,000 or less attached more importance ($p < .02$) to resolving needs for achievement than did fishermen making more than $8,000 per year (5.4 vs. 4.1 means, respectively). Compared with high-income groups, low-income groups might be more frustrated in fulfilling achievement needs in nonrecreational pursuits and might find greater fulfillment in fishing. Interestingly, there were no significant differences on the achievement scale between high- and low-income boat watchers (*i.e.*, those watching ships on the Detroit River) and picnickers in the Belle Isle study.

A third major unmet need satisfied by fishing is that of exploration (means of 5.8 and 5.0 for inland-lake and trout fishermen, respectively; Knopf 1972). Fishing offers the opportunity to seek out new environments and experiences. Comparisons in the Knopf study show that only two other types of recreationists rank higher than fishermen in this category: hikers (6.7) and trailbikers (6.1).

The need to experience natural stimuli also ranked high (7.0) for

both types of fishermen compared to participants in 10 other activities. This suggests that fishermen particularly appreciate natural surroundings.

Not surprisingly, trout fishermen scored the lowest (4.0) of all participants in the 12 activities sampled on our affiliation scale. Lake fishermen near Detroit averaged 5.4 on this scale, and bank fishermen in Detroit averaged 6.4 (Davis 1973). Apparently, types of fishing vary in the degree to which they satisfy unmet needs for affiliation, which we are finding has intra- and inter-group dimensions. Interestingly, "social" campers (in dense campgrounds) scored the highest (7.0) on this scale, while "natural" campers in less intensively developed campgrounds received one of the lowest scores (4.6) of any of the 12 different types of recreationists (Knopf 1972).

Our studies of why fishermen fish involve only a few of many possible dimensions of recreational motivation. However, we believe there is a package of motivating states to which all types of fishing appeal, and that this package can be more clearly identified as research techniques become more sophisticated. We have focused our research on motives that we regard as the most pervasive and managerially relevant.

Conflicts in Motivations

Michigan's Au Sable River, in addition to offering excellent trout fishing, is one of the most popular canoeing corridors in the Midwest. Public land management agencies in the area are confronted by an increasing number of problems such as overcrowding, environmental degradation, undesirable behavior and conflicts between fishermen and canoeists. We consider here some differences in motives of fishermen and canoeists.

Data collected on 50 canoeists and 25 trout fishermen on the Au Sable River by Knopf (1972) show that these two types of users differ in various need categories. The greatest difference was in their unmet need for affiliation. Fishermen scored lowest (4.0) in affiliation need, whereas canoeists scored higher (6.1) than all other recreationists studied except for social campers (7.0) and trailbikers (6.2). We believe that the affiliation score is high for Au Sable canoeists because of the large number of group-sponsored canoeing trips by high school, church and Boy Scout organizations. Our limited data suggest that canoeists in large groups score higher in inter-group affiliation than do canoeists in smaller parties.[4] We infer that, although fishermen and canoeists share common motivations, the fishermen prefer not to engage in human interaction, whereas the group canoeist on the Au

[4] We are currently refining our affiliation scale to get better measures of these two dimensions of the motivation to be with other people.

Sable seeks it out. This difference in motive might be the key to some conflicts between these two types of recreationists.

Interaction Between Motivations

To pursue the proposition that different motivations underlie some of the conflicts between canoeists and fishermen using the Au Sable River system, we will look at some data from Study 3 of the characteristics and attitudes of the users of that river (Bassett *et al.* 1972). Three unmet needs important to fishermen and canoeists will be considered: affiliation, experiencing nature and achievement.

Affiliation. We asked canoeists on the Main Stream of the Au Sable River how they viewed the number of people using the river: too many, about right, too few and undecided. On another scale, we determined that 222 had a low and 376 had a high unmet need for affiliation. Of the canoeists who strongly sought affiliation, only 5 percent felt that overcrowding was a problem on the river, whereas 56 percent felt overcrowding was not yet a problem:

Response	*Need for Affiliation*	
	Low	*High*
	—— percent ——	
Too many	22	5
About right	44	56
Too few	3	8
Undecided	31	31

These same canoeists plus 376 fishermen on the Main Stream were asked if they thought conflicts exist between canoeists and fishermen. Among high-affiliation canoeists, twice as many did not see as did see a conflict (44 vs. 22 percent); more of the canoeists with a low affiliation motive saw a conflict than did those with a high need for affiliation (30 vs. 22 percent):

Response to Question "Are there conflicts?"	*Need for Affiliation*	
	Low	*High*
	—— percent ——	
By canoeists:		
Yes	30	22
No	26	44
Undecided	44	34
By fishermen:		
Yes	64	48
No	15	26
Undecided	21	26

Both high- and low-affiliation fishermen tended to answer "yes, conflicts exist," however, 16 percent more (64 vs. 48 percent) of those scoring low on this need gave this response. Conflicts were perceived by more fishermen than canoeists, and higher percentages of each type of user responded "Yes" (*i.e.,* perceived a conflict) if his affiliation score was low rather than high. Thus, level of motivation on that dimension influences perception of conflict. It seems reasonable to suggest that these perceptions affected user satisfaction.

Experience Nature. Over 380 Main Branch fishermen responded to questions asking how strongly they objected to seeing canoeists and how much they favored or opposed a series of proposals restricting canoe traffic. Fishermen who registered a high need to experience nature were strongly in favor of restricting use by canoeists:

Items Responded To	*Need to Experience Nature* — percent —
	Low	*High*
Object very strongly to seeing canoeists	12	88
Very much favor a permit system restricting number of canoes	17	83
Very much favor setting time or days when entire river could be used by fishermen	17	83
Very much favor setting times/days when certain parts of river could be used by fishermen	20	80

These same questions were asked of 199 fishermen using the South Branch of the Au Sable River whose riverbank, in contrast with the Main Stream, contains relatively few cottages and campsites. The South Branch fishermen who scored high in the need to experience nature were even more strongly in favor of restricting canoes than Main Stream fishermen. This is not surprising because many of the South Branch fishermen sampled were fishing in the Mason Tract, an undeveloped 14-mile stretch cherished for its wild qualities. The motivational bases of conflict seem apparent.

Achievement. Trout fishermen were asked how many days they planned to use the Au Sable River during 1971. Those who scored high in their need to achieve seem to have a greater commitment to this stream, measured by planned days of use that year:

Days of Use	*Need to Achieve* — percent —
	Low	*High*
0–4	21	8
+4	79	92

We also found that those fishermen with higher commitments (*i.e.*, those who planned to use the stream more often) objected most strongly to seeing canoeists.

Planned Days of Use, by Stream	*Objected Strongly or Very Strongly to Seeing Canoeists*	
	Yes	*No*
	— percent —	
On Main Stream:		
0–4	5	18
5–8	9	20
8+	86	62
On South Branch:		
0–4	9	25
5–8	14	20
8+	77	55

Therefore, it seems that the level of achievement motive is related to the likelihood of user conflict.

These results are only a few of many that we could cite to suggest relationships between user preference and satisfaction and, therefore, between user preference and resource management. The implications to management are certainly considerable, and will be discussed briefly.

DISCUSSION

We are not prepared to construct a motivational profile of fishermen, for at least four reasons. First, our research has concentrated on the development of instruments for identifying and measuring motivations. Second, our preliminary results show that motivations vary by different types of fishermen. Third, in some studies our test subjects were few in number and not selected randomly, so generalizations to larger populations are inappropriate. Finally, our scales are still being refined and need additional checking for reliability. Our preliminary findings do suggest, however, that we can draw some conclusions relevant to resource management.

Managers must frequently decide the kinds and number of opportunities that should be provided on a specific area. Information on motivations can help for it shows that users with one set of motivations may interfere with users having different sets. For example, group canoeists on the Au Sable have strong preferences for human interaction, while the trout fishermen are interested in escaping temporarily from human interaction and in experiencing a natural environment. Perhaps managerial practices should be implemented to separate physically or temporally those users with incompatible

motives. This can be done by referring socially orientated canoeists to alternative rivers that are not so attractive to trout fishermen or by allocating certain stretches of the river to different uses at different times. Therefore, by supplementing the resource and activity approaches with behavioral information, we could still provide for diversity within a spectrum of opportunity while simultaneously reducing conflicts.

Understanding user motivations is also helpful in establishing other types of user controls, especially those using positive reinforcement. For example, we discovered that most canoeists were not aware of some of the ways they bother fishermen. They did not recognize that a friendly "Catching any?" soon becomes tedious to a fisherman who has in fact caught nothing. And they did not recognize that ramming logjams and otherwise disturbing stream cover (part of their "adventure") is detrimental to fish habitat. If information were provided to canoeists alerting them to the undesirable effects of such behavior, that behavior might be less likely to occur. The use of education and selected types of reward have been found to be effective managerial controls in other behavioral research (Clark *et al.* 1972).

Motivational and other behavioral information can also be helpful in determining recreation area carrying capacities. Lime and Stankey (1971) have explained the necessity for getting at the psychological and sociological dimensions of that concept, and Stankey's (1973) research, which shows decreasing wilderness user satisfaction with increasing numbers of social encounters, documents their case. Furthermore, behavioral information can be used with the economic approach to help establish pricing mechanisms as a form of rationing (Fisher and Krutilla 1972).

Behavioral information can also help the economic approach define the role of different levels of government in financing opportunities. For example, economists suggest that those opportunities which provide few indirect or secondary benefits to nonusers (or few "external economies of consumption") should be paid for largely by the participants utilizing these opportunities. On the other hand, those opportunities that provide spinoff benefits to people who do not visit the sites should be financed to some degree by everyone who benefits, whether present or future. It seems reasonable to suggest that behavioral information, such as that reported on the stress-mediating value of the activities on Belle Isle, can help enhance the judgments necessary for these types of economic decisions.

Finally, if recreation is an experience that is sought to help resolve problems felt before the individual chooses to use recreation resources, then good planning and management require that we continue to

look beyond the resource to understand what the outputs of the recreation system are. Our studies, and the one by Mandell and Marans (1972), support the conclusion that increasing numbers of outdoor recreationists are using natural areas to help resolve problems they experience back home. We must give serious consideration to the degree to which we should be providing opportunities for temporarily resolving problems in outdoor recreation areas that reappear when the user gets back home. In some ways we might be applying Band-Aids to symptoms rather than attacking causes. This is an acceptable prescription in the short run but inadequate management in the long run. Only when we begin to make progress in resolving the inadequacies of man's nonleisure environment can we hope to take some of the pressure off and successfully maintain the physical resources in his leisure environment. As de Grazia (1970) has stated: "Only the city can save the wilderness."

Even if many of the inadequacies of man's home and work environments are improved, man will still be motivated to use other environments for a variety of recreation-related purposes. But until we get at these problems, it is unlikely that our outdoor recreation areas can ever be allocated and managed to provide an appropriate variety of opportunities for recreation experiences of the highest possible quality. It is a dilemma that affects all of us.

LITERATURE CITED

Bassett, John R., B. L. Driver and Richard M. Schreyer.
1972. User study: characteristics and attitudes, Michigan's Au Sable River. Northeast Michigan Regional Planning and Development Commission, Rogers City, Michigan. 140 p.

Boulding, Kenneth E.
1956. The image: knowledge in life and society. The University of Michigan Press, Ann Arbor. 175 p.

Burch, William R., Jr.
1965. The play world of camping: research into the social meaning of outdoor recreation. Amer. J. Sociol. 70(12): 604-612.

Catton, William R., Jr.
1969. Motivations of wilderness users. Pulp and paper magazine of Canada, Woodlands Section. Dec. 19: 121-126.

Clark, Roger N., John C. Hendee and Frederick L. Campbell.
1971. Values, behavior, and conflict in modern camping culture. J. Leisure Research. 3(3): 143-159.

———, Robert L. Burgess and John C. Hendee.
1972. The development of anti-litter behavior in a forest campground. J. Applied Behavior Analysis. 5(1): 1-5.

Clawson, Marion and Jack Knetsch.
1966. Economics of outdoor recreation. The Johns Hopkins Press, Baltimore. 327 p.

Davis, Randall L.
1973. Selected motivational determinants of recreational use of Belle Isle Park in Detroit. Master's thesis, School of Natural Resources, University of Michigan, Ann Arbor.

Driver, B. L.
1972. Potential contributions of psychology to recreation resource management. *In* Environment and the social sciences: perspectives and applications (J. F. Wohlwill and D. H. Carson, Ed.). American Psychological Association, Inc., Washington, D. C. p. 233-244.

de Grazia, Sebastian
1970. Some reflections on the history of outdoor recreation. *In* Elements of outdoor recreation planning (B. L. Driver, Ed.). University Microfilms, Xerox Corporation, Ann Arbor, Michigan. p. 89-97.

Fisher, Anthony and John Krutilla.
1972. Determination of optimal capacity of resource-based recreation facilities. Natural Resources J. 12(3):417-444.
Grubb, Eric A.
1973. Temporal integration as a determinant of job boredom and consequent selection of recreation activities. Doctoral dissertation, School of Natural Resources, The University of Michigan, Ann Arbor.
Hendee, John C., William R. Catton, Jr., Larry D. Marlow and Frank Brockman.
1968. Wilderness users in the Pacific Northwest: their characteristics, values, and management preferences. U.S. Dept. Agric. Forest Serv. Res. Pap. PNW-61. 92 p.
Howard, Alan and Robert B. Scott.
1965. A proposed framework for the analysis of stress in the human organism. Behavioral Science. 10(2):141-160.
Knetsch, Jack L.
1970. Assessing the demand for outdoor recreation. *In* Elements of outdoor recreation planning. (B. L. Driver, Ed.). University Microfilms, Xerox Corporation, Ann Arbor, Michigan. p. 131-136.
Knopf, Richard C.
1972. Motivational determinants of recreation behavior. Master's thesis, School of Natural Resources, University of Michigan. Available from University Microfilms, Xerox Coroporation, Ann Arbor, Michigan No. M-4244. 268 p.
Kulik, James A., William R. Revelle and Chen-Lin Kulik.
1970. Scale construction by hierarchical cluster analysis. Unpublished paper, Center for Research on Learning and Teaching. The University of Michigan, Ann Arbor.
Lime, David W. and George H. Stankey.
1971. Carrying capacity: maintaining outdoor recreation quality. *In* Recreation symposium proceedings. U.S. Dept. Agric. Forest Service, Northeastern Forest Experiment Station, Upper Darby, Pa. p. 174-184.
Lucas, Robert C.
1964. Wilderness perception and use: the example of the Boundary Waters Canoe Area. Natural Resources J. 3(1):394-411.
Mandell, Lewis and Robert Marans
1972. Participation in outdoor recreation: a national perspective. Report prepared for U.S. Dept. Interior, Bureau of Outdoor Recreation. Survey Research Center, Institute for Social Research, University of Michigan, Ann Arbor. 59 p.
Marans, Robert W.
1972. Outdoor recreation behavior in residential environments. *In* Environment and the social sciences: perspectives and applications (J. F. Wohlwill and D. H. Carson, Ed.). American Psychological Association, Inc., Washington, D.C. p. 217-232.
Miller, George A., Eugene Galanter and Karl H. Pribram.
1960. Plans and the structure of behavior. Holt, Rinehart and Wilson, New York. 226 p.
Nunnally, Jum C.
1967. Psychometric theory. McGraw Hill, New York. 640 p.
Say, E. Wayne.
1971. The meanings of a natural area to its users. Master's thesis, School of Natural Resources, University of Michigan, Ann Arbor.
Shafer, Elwood L., Jr., and James Mietz.
1969. Aesthetic and emotional experiences rate high with Northeast wilderness hikers. Environment and Behavior. 1(2):187-197.
Stankey, George H.
1973. Strategies and problems in management for wilderness quality. *In* Natural environments: studies in theoretical and applied analysis, (J. V. Krutilla, Ed.). Resources for the Future, Johns Hopkins University Press, Baltimore. p. 88-114.
Twiss, Robert H.
1970. Supply of outdoor recreation. *In* Elements of outdoor recreation planning B. L. Driver, Ed.). University Microfilms, Xerox Corporation, Ann Arbor, Michigan. p. 137-143.
White, R. W.
1959. Motivation reconsidered: the concept of competence. Psychol. Review. 66(5): 297-333.
Witt, Peter A. and Doyle W. Bishop.
1970. Situational antecedents to leisure behavior. J. Leisure Research. 2(1):64-77.

RECREATIONAL PREFERENCES FOR BIRDS IN SASKATCHEWAN

DOUGLAS H. SCHWEITZER
Institute for Northern Studies, University of Saskatchewan, Saskatoon

DAVID A. SCOTT
Department of Psychology, University of Saskatchewan, Saskatoon

ARTHUR W. BLUE
Indian and Northern Education Program, University of Saskatchewan, Saskatoon; and

JONATHAN P. SECTER
Canadian Wildlife Service, Prairie Migratory Bird Research Centre, Saskatoon, Saskatchewan

INTRODUCTION

A significant portion of wildlife management effort is concentrated on the maintenance and enhancement of game species for use by hunters. However, wildlife managers have recognized that their clientele is much broader and have been expanding their provision of services accordingly. Planning wildlife management programs and allocations for wildlife and other nonmarket recreational resources initially requires the identification of a broad range of potential activities as products of wildlife management, and the prospective users of these products. This paper reports on an effort to identify avian wildlife products, users and preferences in Saskatchewan.

METHODS

This research is part of a larger study initiated and supported by the Canadian Wildlife Service at the Institute for Northern Studies, University of Saskatchewan. The study comprises two main phases:

1. (a) The definition of the products of avian wildlife management.
   (b) The identification of the users of these products.
   (c) The determination of the preferences of the users for these products.
2. (a) The definition of suitable units by which to measure the production and consumption of these products.
   (b) The determination of the participation patterns of the identified users.
   (c) The estimation of the benefits accruing to the users through consumption of preferred products.

The present paper is a report on research progress within phase one. This work was conducted throughout 1972 by a study team

comprising a systems engineer, a wildlife biologist, a psychometrician and an educational psychologist. The utility of the interdisciplinary approach adopted in this study lay not in the mere representation and participation of each discipline but in continuous interaction throughout the course of the research.

The first step in the study was to identify empirically the various ways in which people interact with birds. It could not be assumed that several broadly defined traditional categories adequately represented these interactions. Indeed, the wide range of activities subsumed by terms such as hunters and naturalists were far too heterogeneous for arbitrary use. The technique used to assess public preferences for the various bird-oriented recreational products, therefore, had to be such that relatively homogeneous groupings of activities could be identified as they are perceived by the public. The statistical procedure of factor analysis (Harman 1967, 1968; Horst 1965) was selected for this purpose. It is a technique that classifies, without any foreknowledge of their structure of independence, a broad set of variables on the basis of their intercorelationships.

In examining wildlife-user interactions the study team determined that there were at least four significant dimensions—time, location, species group, user action—each of which contained several components. Components of time used were: (1) *summer,* (2) *fall,* (3) *winter,* and (4) *spring.* The area dimension was confined to the components: (1) *city residential,* (2) *city parks,* (3) *zoos,* and (4) *rural.* The species dimension was limited to six components: (1) *ducks,* (2) *geese,* (3) *other water and shorebirds,* (4) *songbirds,* (5) *birds of prey,* and (6) *upland game birds.* In addition, one question on shooting cranes was included. It was decided to indicate user actions with a key word plus qualifying words or phrases in parentheses on the questionnaire. Three user actions with qualifiers are identified as follows: (1) *observe* (watch, listen to), (2) *study* (keep written records, count, identify, band, collect specimens, photograph, tape-record, sketch, paint), and (3) *shoot* (kill).

This is the simplest possible breakdown of the four dimensions which still retains sufficient information for resource managers as to user preferences. Because certain activities, particularly hunting, only take place during certain time periods, the number of logically possible activities will be reduced accordingly. The time dimension, therefore, could be confined to the four seasons without any serious loss in potential information. The location dimension was not further subdivided as the species dimension would provide a general indication of habitat within the selected location components. Finally, two constraints were used to select components for the user action dimension. First, any user action that had an implication for the

manager was used. Second, user actions that appeared to have the *same* implication for the manager were combined.

Specific activities were described by combining one component from each dimension. This procedure relies on an interaction between combined components which makes preferences for the entire activity different than the sum of preferences for the individual components. All possible combinations resulted in the definition of 288 ($4 \times 4 \times 6 \times 3$) activities. However, by eliminating illogical, illegal and marginally feasible combinations the activity list was reduced to 76 specific items. It was necessary that the activities derived be meaningful to the user and that users be able to differentiate among activities. Furthermore, products ultimately defined in this exercise had to be meaningful to the resource manager.

A questionnaire was designed to investigate the preferences of the public for 76 bird-oriented recreational activities. In addition, several items which referred to passive actions such as reading about birds, and watching films about birds were included, but without reference to the other dimensions—time, area and species.

The questionnaire allowed the respondent to indicate the degree of preference he had for each activity on an arbitrary nine point scale, ranging from an indication that the respondent would "*dislike very much*" to participate in the activity through an indication of indifference to an indication that the respondent would "*like very much*" to participate in the activity. It was presumed that for each activity there is a continuum of preference. The respondent was asked to assume that he had the opportunity to participate in the activity.

Questionnaires were distributed to a sample of 3,066 (0.85 percent) Saskatchewan households randomly selected from commercial city directories and rural postal directories. Six hundred and ninety-four (22.6 percent) returns were used in the analysis. A subsample of 84 questionnaire non-respondents was selected for personal interview in an attempt to account for non-response bias.

Correlations among respondents' expressed preferences for all activities were calculated. Factor analysis of the resultant correlation matrix revealed those activities that are perceived in a homogeneous fashion by our sample of the Saskatchewan population. The mean preference of each individual over all the activities within each factor was calculated. Individuals were thereby grouped into nine categories as S+, So, S−, O+, Oo, O−, H+, Ho, H−,[1, 2] on the basis of their mean preference for items within each of three identified factors.

[1] S+ = Study positive; O+ = Observe positive; H+ = Hunt positive
So = Study indifferent; Oo = Observe indifferent; Ho = Hunt indifferent
S− = Study Negative; O− = Observe negative; H− = Hunt negative

[2] Arbitrary division of preferences:

Positive preference score	(S+, O+, H+) : $6.000 < Y < 9.000$.
Indifferent preference score	(S+, O+, H+) : $4.000 < Y < 6.000$.
Negative preference score	(S−, O−, H−) : $1.000 < Y < 4.000$.

RESULTS

Preferences reported for studying, observing and hunting birds are independent of one another (Appendix 1): Because the three factors *are* independent, it is not possible to predict an individual's preferences for the other activity sets, given a knowledge of his preference for one activity set. A naturalist, therefore, may or may not be interested in either simple observation of birds or in hunting. Likewise, one cannot assume that a hunter would or would not prefer additional opportunities for simple observation of birds. Thus, bird management programs have at least three categories of uses to consider. What remains is to identify the nature and magnitude of stated preferences for these uses.

TABLE 1. PERCENT OF RESPONDENTS EXPRESSING POSITIVE, INDIFFERENT OR NEGATIVE PREFERENCES FOR PARTICIPATION IN OBSERVE, STUDY AND HUNT ACTIVITIES, BY LOCATION OF RESIDENCE

Percent Respondents	Activities								
	Observe			Study			Hunt		
	Rural	Urban[1]	Total	Rural	Urban	Total	Rural	Urban	Total
Positive	86.7	87.7	87.3	42.1	30.3	34.1	42.7	28.9	33.9
Indifferent	12.2	12.3	12.3	50.0	58.0	55.6	20.3	13.9	15.9
Negative	1.1	0.0	0.4	7.9	11.7	10.3	37.0	57.2	50.2
Sample			693			624			666

[1] Urban = 10 major Saskatchewan population centers (population > 5,000).

Almost 87 percent of the sample expressed positive attitudes toward participation in some form of bird observation. In contrast, approximately 66 percent of the sample expressed either negative or indifferent preference for participation in study and hunt activities (Table 1). These results cannot be viewed as an expression of either anti-studying or anti-hunting sentiment in Saskatchewan as respondents were asked to express an opinion only on their own potential participation in any specified activity. They provide an indication of how the people of Saskatchewan personally wish to use the bird resources of the province for recreational purposes.

Thirty-two percent of the sample indicated some degree of actual participation in bird hunting in Saskatchewan in 1971 and 34 percent indicated a positive preference for participation in hunting if given the opportunity. Thus, in hunting where the management programs and opportunities are most widespread there exists only a small differential between stated preference and actual participation in the province of Saskatchewan. There is a much wider difference between th proportion of the sample expressing positive preferences for observe activities (87.3 percent) and those actually participating in

these activities (6.1 percent). The situation is similar for study activities (34.1 percent and 30.0 percent).

No important differences were noted within the observe factor among rural and urban residents (Table 1). Rural respondents appeared to be more interested than urban respondents in participating in study and hunt activities.

Respondents with positive activity preferences, although not tested statistically, appear not to discriminate among species when observing and studying (Table 2). However, preference for cranes among hunters was considerably lower than for all other game birds. The similarities of preferences among species groups for observation and study is noteworthy in terms of the relatively small amounts of management attention currently devoted to nongame species.

TABLE 2. SPECIES PREFERENCES OF RESPONDENTS HAVING POSITIVE PREFERENCES FOR OBSERVE (O+), STUDY (S+), AND HUNT (H+) ACTIVITIES

	Respondent Group					
	O+		S+		H+	
Species Group	Value[1]	Rank	Value	Rank	Value	Rank
Songbirds	7.844	1	7.434	2	N.A.	–
Upland game birds	7.700	2	7.556	1	8.101	1
Geese	7.604	3	7.287	3	8.005	3
Ducks	7.516	4	7.172	5	8.009	2
Other water and shorebirds	7.427	5	7.198	4	N.A.	–
Birds of prey	6.908	6	7.081	5	N.A.	–
Cranes	N.A.	–	N.A.	–	5.010	4

[1] Average preference scale value (9 = Like very much; 5 = Indifferent; 1 = Dislike very much).

Location preferences (Table 3), although not yet tested for significance, appear to be very similar. The implication is that city areas are of equal importance to rural areas for studying and observing birds. It is notable that reactions to observing birds in zoos were so mixed that the activity did not correlate with any of the three factors. It is also notable that studying birds in zoos occupies the lowest rank in the study factor.

TABLE 3. LOCATION PREFERENCES OF RESPONDENTS HAVING POSITIVE PREFERENCES FOR OBSERVE AND STUDY ACTIVITIES

	Activity			
	O+		S+	
Location	Value[1]	Rank	Value	Rank
Rural areas	7.635	2	7.478	1
City residential areas	7.880	1	7.439	2
City parks	7.322	3	7.006	3
Zoos	N.A.	–	6.857	4

[1] Average preference scale value (9 = Like very much; 5 = Indifferent; 1 = Dislike very much).

The range of seasonal preferences for observe and study activities is nearly the same (Table 4). The decrease in preference for winter activities is nearly identical for both groups. This decrease is to be expected with Saskatchewan winters. Indeed, an even greater decrease may have been expected.

TABLE 4. SEASON PREFERENCES OF RESPONDENTS HAVING POSITIVE PREFERENCES FOR OBSERVE AND STUDY ACTIVITIES

	Activity			
	O+		S+	
Season	Value[1]	Rank	Value	Rank
Spring	7.814	1	7.552	1
Summer	7.697	3	7.345	3
Fall	7.746	2	7.489	2
Winter	7.039	4	6.788	4

[1] Average preference scale value (9 = Like very much; 5 = Indifferent; 1 = Dislike very much).

CONCLUSION

This research has determined that the people of Saskatchewan identify three distinct and independent sets of activities. Thus bird management programs have at least three categories of uses to consider. However, within each of these sets of activities there appears to be little differentiation in species, season and location preferences for recreational uses of birds. These results indicate that a reorientation in migratory bird management programs may be required to meet the desires of the Saskatchewan public for a broad spectrum of recreational opportunities. Procedures and methods described herein are useful to the resource manager in identifying public preferences for recreational opportunities.

LITERATURE CITED

Harman, H. H.
1967. Modern factor analysis. Univ. of Chicago Press, Chicago. 471 pp.

———.
1968. Factor analysis. *In* Handbook of Measurement and Assessment in Behavioral Sciences. D. K. Whitla, Editor. Addison-Wesley Publ. Co., Reading, Mass., Ch. 4:143-170.

Horst, P.
1965. Factor analysis of data matrices. Holt, Rinehart and Winston, Inc., New York. 730 pp.

APPENDIX 1. FACTOR ANALYSIS OF RESPONDENTS' INDICATED PREFERENCES FOR BIRD-ORIENTED RECREATIONAL ACTIVITIES

Activity	Factor Loadings[2] Factor 1 (Study)	Factor 2 (Observe)	Factor 3 (Hunt)
OBSERVE DUCKS IN CITY PARKS IN:			
a) Summer	0.14665	0.63489	-0.17813
b) Winter	0.13344	0.55150	-0.00013
OBSERVE DUCKS IN RURAL AREAS IN:			
a) Spring	0.17435	0.77550	0.15584
b) Summer	0.14416	0.77646	0.11097
c) Fall	0.12169	0.72285	0.22315
OBSERVE GEESE IN CITY PARKS IN:			
a) Summer	0.12288	0.64576	-0.11282
b) Winter	0.17680	0.53352	0.01706
OBSERVE GEESE IN RURAL AREAS IN:			
a) Spring	0.18647	0.77517	0.20248
b) Summer	0.17017	0.80149	0.16656
c) Fall	0.15276	0.72656	0.26458
OBSERVE OTHER WATER AND SHOREBIRDS IN CITY PARKS IN:			
a) Summer	0.12316	0.67300	-0.19035
b) Winter	0.17465	0.52408	-0.05225
OBSERVE OTHER WATER AND SHOREBIRDS IN RURAL AREAS IN:			
a) Spring	0.18408	0.79010	0.05305
b) Summer	0.19256	0.79479	0.02094
c) Fall	0.13389	0.80199	0.09107
OBSERVE SONGBIRDS IN CITY RESIDENTIAL AREAS IN:			
a) Spring	0.13765	0.73076	-0.33635
b) Summer	0.14823	0.74583	-0.33348
c) Fall	0.16561	0.74911	-0.30624
d) Winter	0.16612	0.65552	-0.20141
OBSERVE SONGBIRDS IN CITY PARKS IN:			
a) Spring	0.17795	0.74137	-0.32669
b) Summer	0.17339	0.74630	-0.33853
c) Fall	0.18098	0.74503	-0.33073
d) Winter	0.20589	0.65679	-0.21594
OBSERVE SONGBIRDS IN RURAL AREAS IN:			
a) Spring	0.19048	0.75344	-0.11535
b) Summer	0.19078	0.76918	-0.13372
c) Fall	0.18790	0.76218	-0.10136
d) Winter	0.17553	0.64477	-0.02615
OBSERVE UPLAND GAMEBIRDS IN RURAL AREAS IN:			
a) Spring	0.19843	0.77354	0.25658
b) Summer	0.17600	0.78104	0.24918
c) Fall	0.17129	0.76421	0.32454
d) Winter	0.16554	0.66381	0.33981
OBSERVE BIRDS OF PREY IN RURAL AREAS IN:			
a) Spring	0.16880	0.50904	0.28421
b) Summer	0.17506	0.51869	0.29284
c) Fall	0.16469	0.55402	0.28481
d) Winter	0.13264	0.55331	0.30202
OBSERVE BIRDS IN ZOOS ANYTIME DURING THE YEAR:	0.17248	0.14876	-0.11561
STUDY DUCKS IN CITY PARKS IN:			
a) Summer	0.83911	0.19097	-0.02713
b) Winter	0.76677	0.21139	0.01091
STUDY DUCKS IN RURAL AREAS IN:			
a) Spring	0.88813	0.22794	0.11885
b) Summer	0.89431	0.23170	0.09333
c) Fall	0.86007	0.23212	0.12727
STUDY GEESE IN CITY PARKS IN:			
a) Summer	0.83398	0.19381	-0.00278
b) Winter	0.79154	0.22098	-0.00658
STUDY GEESE IN RURAL AREAS IN:			
a) Spring	0.88689	0.19716	0.12562
b) Summer	0.89493	0.20747	0.10315
c) Fall	0.85480	0.21541	0.16617

APPENDIX 1. (CONT.)

Activity	Factor Loadings Factor 1 (Study)	Factor 2 (Observe)	Factor 3 (Hunt)
STUDY OTHER WATER AND SHOREBIRDS IN CITY PARKS IN:			
a) Summer	0.86712	0.16821	-0.06199
b) Winter	0.79071	0.21054	-0.02547
STUDY OTHER WATER AND SHOREBIRDS IN RURAL AREAS IN:			
a) Spring	0.89855	0.20157	0.10149
b) Summer	0.89957	0.19973	0.10271
c) Fall	0.86293	0.21743	0.11260
STUDY SONGBIRDS IN CITY RESIDENTIAL AREAS IN:			
a) Spring	0.88016	0.17484	-0.16466
b) Summer	0.88813	0.17774	-0.15061
c) Fall	0.88975	0.18516	-0.14760
d) Winter	0.84386	0.23115	-0.10378
STUDY SONGBIRDS IN CITY PARKS IN:			
a) Spring	0.89039	0.17099	-0.16028
b) Summer	0.89632	0.18549	-0.15728
c) Fall	0.89844	0.18266	-0.14340
d) Winter	0.84417	0.21781	-0.10027
STUDY SONGBIRDS IN RURAL AREAS IN:			
a) Spring	0.91161	0.18822	-0.03684
b) Summer	0.90878	0.19833	-0.03928
c) Fall	0.90712	0.20403	-0.03907
d) Winter	0.83973	0.21629	0.00450
STUDY UPLAND GAMEBIRDS IN RURAL AREAS IN:			
a) Spring	0.88138	0.20260	0.15499
b) Summer	0.89082	0.20884	0.15703
c) Fall	0.86776	0.20707	0.16542
d) Winter	0.82752	0.23873	0.18160
STUDY BIRDS OF PREY IN RURAL AREAS IN:			
a) Spring	0.83111	0.19407	0.14369
b) Summer	0.84052	0.19868	0.13518
c) Fall	0.83038	0.19606	0.15260
d) Winter	0.78416	0.21606	0.17003
STUDY BIRDS IN ZOOS ANYTIME DURING THE YEAR:	0.65856	0.00598	-0.08657
SHOOT DUCKS:	0.04887	0.00262	0.77853
SHOOT GEESE:	0.03333	0.00671	0.76829
SHOOT CRANES:	0.02912	-0.03659	0.58795
SHOOT UPLAND GAMEBIRDS:	0.03149	0.00784	0.78153
HUNT FOR GAMEBIRDS EVEN IF UNSUCCESSFUL IN SHOOTING THEM:	0.04716	0.05843	0.78512
READ ABOUT BIRDS:	0.38849	0.42200	0.04636
LOOK AT PICTURES, TV OR FILMS ABOUT BIRDS:	0.25232	0.46155	0.04603
HELP ENSURE THAT I OR MY CHILDREN CAN PARTICIPATE IN THE FUTURE IN ACTIVITIES INVOLVING BIRDS:	0.31537	0.51978	0.17214

[1] Factor analysis permits identification of groups of variables which are relatively homogeneous both in content in the way they are perceived by the public. What originally was presented as 80 separate activities now appears to be three relatively homogeneous groupings of attitudes based upon inter-item correlations.

[2] Factor loadings can be directly interpreted as the correlation of each activity with each identified factor. An activity was declared to load significantly on a factor if it had a loading of 0.40000 with that factor.

VISITOR EVALUATIONS OF A DEVELOPED OUTDOOR RECREATION AREA ON A NATIONAL WILDLIFE REFUGE

RONALD L. FOWLER
Bureau of Sport Fisheries and Wildlife, Waycross, Georgia; and

RICHARD L. BURY
Texas A&M University, College Station, Texas

We would like to report the results and implications of a study of national wildlife refuge visitors; the data were gathered during the summer of 1971 at the Okefenokee National Wildlife Refuge. The research was an attempt to determine the attitudes, characteristics, and satisfaction levels of visitors to the Suwannee Canal Recreation Area (SCRA), Okefenokee National Wildlife Refuge in southeast Georgia.

THE NEED FOR THIS STUDY

Public Law 87-714 authorized management of national wildlife refuges for outdoor recreation if the primary purpose of the refuge was not compromised, and if the cost of the recreational programs was funded. The National Academy of Science study conference recommended that research should be conducted to provide feedback from users to the managers of activities. Hendee stated that the proper objective for wildlife management is "benefit to people" and that this objective is not totally served by an exclusive focus on "maintenance of wildlife populations and their environment," although the two are certainly related.

According to the *Outdoor News Bulletin,* the Bureau of Sport Fisheries and Wildlife is seriously overcommitted and the increasing public use of the national wildlife refuge system alone is endangering the original purposes for which it was established. Refuge staffs are unable to provide the needed visitor services and maintain the basic wildlife programs because of funding deficiencies. The system is receiving 20 million visitors per year and sharp increases in use are anticipated.

THE STUDY SITE

The Suwannee Canal Recreation Area is located 11 miles southwest of Folkston, Georgia. It is the public use access area administered by the Bureau of Sport Fisheries and Wildlife. Prior to 1967 it was a fishing access point, but since that time more than $600,000 has been invested on facilities and services at the recreation site in an attempt to create an exceptional outdoor recreation area.

Facilities at the SCRA consisted of: (1) a concession-operated fishing center, (2) a boat basin with rental boats and motors, (3) a seven-mile auto nature drive, (4) a swamp interpretive building and information center, (5) a 4,000-foot boardwalk out into Chesser Prairie, (6) picnic tables, grills, and a picnic pavillion, and (7) restroom facilities.

METHODOLOGY

Two sociological instruments were developed for use in this study. The first was a semantic differential scale which was used to measure affective response of the visitor to the refuge resource, the second was a modified scale in the Likert format which was used to determine which activity-benefit constructs were associated with a visit to a national wildlife refuge. In addition, the methodology employed by Reid in a nation-wide study of user desires was used to measure visitor satisfaction levels for fourteen facilities and services.

The semantic differential (SD) measures people's reactions to stimulus words and concepts in terms of ratings with contrasting adjectives. According to Heise, a number of considerations are involved in SD methodology: (1) Ratings on bipolar adjective scales tend to be correlated, these correlations identify three basic dimensions of response which account for most of the co-variation in ratings. The three dimensions, which have been verified and replicated in an impressive number of studies, have been labeled Evaluation, Potency, and Activity (EPA). (2) EPA measurements are appropriate when one is interested in affective response. The EPA system is notable for being a multivariate approach to measurement of affective response.

For the purposes of this study, nine pairs of bipolar adjectives were chosen to measure the affective response of the visitor to the refuge resource. The pairs were chosen by the researchers to represent each of the expected EPA dimensions. The SD was administered to the on-site respondents and then factor analysis was used to determine the actual dimensions and the factor loadings for each of the pairs of bipolar adjectives.

Hendee *et al.* conducted a comprehensive and sophisticated study attempting to understand the attitudes of wilderness users. Hendee's attitude scale was composed of sixty items, each of which was a brief description of wilderness type areas, activities associated with wilderness areas, and benefits that might be obtained from recreation in a wilderness area. The respondents in the study of wilderness users were asked to indicate their affect toward each cognition, that is, the degree to which they liked or disliked each stimulus. A scoring valence was established so that a high score indicated a convenience

orientation toward wilderness. The items were analyzed and those that showed the highest item-to-total correlations were retained in the final version of the scale. The final score was thought of as essentially a measure of affect toward wilderness.

A second step made by the Hendee group was to factor analyze the responses to the items. A factor analysis of the inter-item correlations yielded seven orthagonal factors to account for the variance in responses. These factors may be thought of as clusters of cognitions which are unified by similar affectual structures among wilderness users.

Hendee's methodology was modified for use in this study. The individuals responded to a list of twenty-five items that might be associated with a visit to a national wildlife refuge. No attempt was made to obtain individual scores; instead the data were factor analyzed to determine which of the activities and benefits clustered together.

RESULTS

A systematic sampling matrix was used to select visitor groups as they departed the SCRA during the fifty-four day study. A checkpoint was established at the refuge exit and 712 groups of visitors were asked to sign a register, and were given a self-administering mail-back questionnaire. Follow-up letters were sent to groups that did not respond within two weeks. A total of 350 usable questionnaires were returned. The usable questionnaires represented 5.8 percent of the visitors to the SCRA during the study period.

More than 60 percent of the groups sampled were from Georgia and Florida. Eight per cent were from theMidwest; 23.6 percent were from the eastern states north of Georgia. Approximately 55 percent of the groups sampled were single families; two or more families comprised 16 percent of the groups. Families plus friends or relatives accounted for about 12 percent of the groups; groups of friends, organized groups, and single persons accounted for the remainder of the sample. An estimated 30 percent of the groups sampled resided within 50 miles of the recreation site.

Four-fifths of the visitors indicated that they were satisfied with the facilities and services as offered. Concession rates were the major source of dissatisfaction.

A semantic differential (SD) scale of nine bipolar adjectives was used to measure affective response to the refuge resource. A study by Wells and Smith indicated that the amount of differentiation in SD scales was substantially greater when adverbial labels were used. The adverbial quantifiers "extremely" and "slightly" were used to en-

courage ratings at other than the end points of the scales in this study.

Factor analysis was used to determine the factor loadings and define the dimensions of the SD scale. The results indicated that there were only two dimensions, Evaluation and Potency (see Table 1). The bipolar adjectives clean/dirty, well kept/poorly kept, and attractive/unattractive loaded on one factor which might be called the Evaluative dimension. Like/dislike, impressive/unimpressive, and big/little loaded on a second factor which might be termed the Potency dimension. The factor loadings for the other three scales were

TABLE 1. FACTOR STRUCTURE: SEMANTIC DIFFERENTIAL SCALE*

		Varimax Loadings	
Bipolar Adjective	Communality	Factor I "Evaluative"	Factor II "Potency"
Like/Dislike	0.431	0.2231	0.5781
Clean/Dirty	0.738	0.8142	0.1964
Well Kept/Poorly Kept	0.790	0.8130	0.2570
Attractive/Unattractive	0.640	0.6953	0.3240
Impressive/Unimpressive	0.467	0.2035	0.5371
Safe/Dangerous	0.323	0.3508	0.3779
Well Managed/Poorly Managed	0.540	0.4736	0.4578
Big/Little	0.431	0.1804	0.6254
Quiet/Noisy	0.398	0.4070	0.3653

*n = 268

judged to be too low and they were not included in the computation of the factor scores which were used to measure affective response.

The difference of means test indicated that the affective response score on the SD scale of those living within 100 miles was more favorable than that of visitors who had traveled a greater distance. The level of probability was less than 0.05. An explanation is that the experience of groups traveling more than 100 miles did not meet their expectations, and consequently, their affective response was lower.

The more favorable affective response by those people living within 100 miles might be associated with a more favorable image of the study site.

Analysis of variance revealed a more favorable affective response score by the 55 percent of the respondents who indicated that they planned a return visit. It seems reasonable to the researchers to suggest that people avoid situations in which they are less favorably impressed; consequently, those visitors with a less favorable affective response score did not plan to return.

Factor analysis was used to determine the underlying constructs concerning activities and benefits associated with a visit to a national wildlife refuge. Varimax rotation, a form of orthagonal rotation, was used to maximize the factor loadings for each of the twenty-five variables. The results suggest two separate constructs, a "nature/outdoor benefit" construct of fifteen variables, and a "commercialism" construct which included six variables. The factor loadings for the other four variables were low and were not a part of the constructs defined by the data. These indeterminate variables were canoeing, harvesting wildlife, absence of people, and camping (Table 2).

An inspection of the data revealed that the means of the "commercialism" variables were on the disagree side of undecided, indicating indecision as to whether they were appropriate on a national wildlife refuge. However, the means of the variables forming the "nature/outdoor benefit" construct ranged between agree and strongly agree, indicating that these were an essential part of the national wildlife refuge experience.

IMPLICATIONS

If a recreation area is evaluated by the proportion of satisfied visitors, then the results of this study indicate that the development of the SCRA was certainly worthwhile. In today's highly urbanized society many people have not had the opportunity to experience their natural heritage. The system of national wildlife refuges could play an important role in providing this experience and the values associated with it.

This study suggests that the visitors have strong feelings concerning the inappropriateness of commercialism within the context of the national wildlife refuge experience. Certain variables such as nature and the out-of-doors were perceived as an integral part of the refuge visit.

This study has also reemphasized the need for recreation managers to view each visitor as an individual with differing needs and expectations. More important, however, is that each visitor has

TABLE 2. FACTOR STRUCTURE: ACTIVITY/BENEFIT CONSTRUCTS*

Variable	Communality	Varimax Loadings Factor I[a]	Varimax Loadings Factor II[b]
Motorboating	0.255	0.0086	0.3740
Canoeing	0.309	0.2400	0.0502
Family Solidarity	0.432	0.5178	0.0732
Breathing fresh air	0.575	0.7028	0.0085
Relieving tensions	0.613	0.7098	0.1027
Chance to acquire knowledge	0.549	0.6973	-0.0566
Remoteness from cities	0.352	0.4904	0.1244
Automobile touring	0.219	0.0735	0.4252
Attain new perspectives	0.438	0.5555	0.0097
Viewing virgin swamp	0.412	0.4648	-0.0297
Talking with tourists	0.408	0.1826	0.4722
Harvesting wildlife	0.179	-0.0326	0.2493
Low cost outdoor recreation	0.422	0.4116	0.2714
Enjoying nature	0.599	0.7387	-0.0210
Seeing wild animals	0.503	0.5630	-0.0053
Camping	0.360	0.1153	0.2552
Viewing naturalist exhibits	0.461	0.5592	0.2547
Private cottages	0.428	-0.0484	0.5493
Looking at scenery	0.552	0.7142	0.0509
Purchasing souvenirs	0.419	0.0912	0.5716
Absence of people	0.214	0.0995	-0.0336
Developed resort facilities	0.418	-0.0964	0.5933
Adventure	0.487	0.4984	0.1541
Solitude	0.473	0.5626	-0.1482
Emotional Satisfaction	0.532	0.5628	-0.0295

*n = 231

[a]"Nature/Outdoor Benefit" construct

[b]"Commercialism" construct

different interests and attitudes and that there is no such thing as an average visitor. The findings of this study indicate that various groups perceive the refuge differently; consequently, the visitor could be provided a choice of several alternative experiences.

ACKNOWLEDGMENTS

We are indebted to Earl Jones, Donald G. Barker, and Carlton S. VanDoren for their constructive comments during the course of this research. Special thanks are extended to Lawrence S. Givens, George Wiseman, Kenneth Butts, and Larry Calvert of the Bureau of Sport Fisheries and Wildlife. This research effort was supported by the Bureau of Sport Fisheries and Wildlife, Division of Wildlife Refuges.

LITERATURE CITED

Fowler, R. L.
1972. Visitors to Okefenokee National Wildlife Refuge, Georgia—their characteristics, attitudes, satisfactions, and preferences. Unpublished MS thesis. Texas A&M University. College Station, Texas. 130 pp.

Heise, D. R.
1970. The semantic differential and attitude research. p. 235-253 In G. F. Summers (ed.) Attitude Measurement. Rand McNally & Co., Chicago.

Hendee, J. C., W. R. Catton, Jr., L. D. Marlow, and C. F. Brockman.
1968. Wilderness users in the Pacific Northwest—their characteristics, values, and management preferences. U. S. Dep. Agr. Forest Service Res. Pap. PNW-61. 92 pp.

Hendee, J. C. and D. R. Potter.
1972. More thoughts on research. Wild. Soc. News. 139:19.

Likert, Rensis.
1932. A technique for the measurement of attitudes. Archives of Psychology. 140:44-53.

National Academy of Sciences.
1969. A program for outdoor recreation research. Washington, D. C. 90 pp.

Reid, L. M.
1963. Outdoor recreation preferences a nationwide study of user desires. The BJ Press. 209 pp. (U. S. Outdoor Recreation Resources Review Commission Study Report 5).

Rust Engineering Company, Urban Planning Group.
1971. A regional recreation feasibility study ("Okefenokee theme park"). Slash Pine Area Plan. and Dev. Comm., Waycross, Georgia. 28 pp.

Wells, W. D., and G. Smith.
1960. Four semantic rating scales compared. J. Applied Psychol. 44:393-397.

Wildlife Management Institute.
1972. Congress holds key to wildlife on public land. Outdoor News Bull. 26(5):1.

HUNTING SATISFACTION: GAME, GUNS, OR NATURE?[1]

DALE R. POTTER, JOHN C. HENDEE, AND ROGER N. CLARK
USDA Forest Service, Pacific Northwest Forest and Range Experiment Station, Seattle, Washington

INTRODUCTION

Two objectives are implied in the history of game management. Each of them offers a different answer to what the products of such management should be and how they can be measured.

In the early days of game management in the United States, the amount harvested was a logical measure of success, so the "game bagged" objective directed managers' efforts. Many success stories attest to its effective application as both game populations and their harvest by hunters increased. Under those conditions, the human benefits which management sought to maximize rested primarily on the amount of game harvested.

As the popularity of hunting increased, the probability of success decreased for a growing army of hunters. A new "days afield" objective emerged to guide game managers. This approach, popular today, implies that human benefits from hunting are maximized by increasing the number of man-days afield. The amount of game bagged is still regarded as important, but managers increasingly point to the number of man-days of recreation as a measure of their success.

These two objectives (game bagged and days afield) recently were examined by Hendee, who suggests an alternative "multiple satisfactions" approach to today's game management.[2]

The multiple satisfactions approach attempts to identify many aspects of the experience which hunters seek. It is based on the notion that a wide variety of satisfactions derive from hunting experiences and these are the direct products of game management. The approach suggests that in addition to seeking increased harvests and more man-days of recreation, game and land managers should coordinate their efforts to provide a full range of the satisfactions which combine to provide the quality experience sought by hunters.

A MULTIPLE-SATISFACTION MODEL OF HUNTING

The purpose of this paper is to examine the validity of propositions embodied in the following multiple-satisfaction model of hunting.

Hunting satisfaction is complex and consists of many elements or

[1] This study was conducted with supplemental financing from the Wildlife Management Institute and American Petroleum Institute. Cooperation from the University of Washington College of Forest Resources and Washington State Department of Game is gratefully acknowledged, as is the assistance of Randel Washburne in computer analysis.

[2] For more detailed explanation and critique of the "game bagged" and "days afield" objectives and description of the "multiple satisfactions" approach, see Hendee (1973).

aspects of the hunting experience. Because of similar underlying meaning these elements may be grouped conceptually into several dimensions. Each dimension represents a major aspect of the hunting experience. Different hunters "harvest" varying degrees of satisfaction from the separate elements and dimensions; but hunters who seek the same prey—waterfowl rather than elk, for example—may generally "harvest" the same dimensions of satisfaction which that particular kind of hunting can best provide.

Thus, game managers can increase hunter satisfaction by modifying conditions under which various kinds of hunting take place.

The specific objectives of this study were to explore the following questions.

1. Do conceptually related elements cluster into dimensions of satisfaction? What is the order of importance of these dimensions?
2. Do the dimensions of satisfaction vary among different kinds of hunters (*i.e.*, for upland bird, waterfowl, small game, deer, elk, and other big game)?
3. Do the dimensions of hunting satisfaction vary with hunter characteristics, such as age, education, residence, hunting experience and interest?
4. What game management implications are apparent from variation or similarities in the dimensions of satisfaction sought by different kinds of hunters?

METHOD

Data for this study came from a 2 percent-interval sample of the 333,257 residents who held Washington State hunting licenses in 1970. Licenses were stratified in a filing system according to county of purchase, license dealer, and the three kinds of licenses (for hunting only, both hunting and fishing, and hunting and fishing in only one county). Every 50th license was selected, resulting in a proportional sample according to place of residence (assuming that place of purchase was equal to county of residence) and kind of license. The 1,500 out-of-state hunters (less than one-half percent of the licenses) were not included because of sampling difficulties.

A 13-page, photo-reduced questionnaire was mailed on March 1, 1971; a postcard reminder was mailed 1 week later to nonrespondents; and two follow-up questionnaires (including a personal letter urging response) were mailed at subsequent 10-day intervals. The total response was excellent, yielding 5,540 usable questionnaires for an 85.4-percent return.[3]

[3] Readers interested in questionnaire construction are referred to Potter *et al.* (1972).

A telephone follow-up of 61 nonrespondents revealed no great differences from respondents in key variables, such as game preference, hunting experience, and age. Compared with respondents, the nonrespondents reported a little less success and more frequently mentioned that their interest in hunting was decreasing. No adjustments were made for nonresponse bias due to the fairly complete response and these minor differences found in nonrespondents.

Designing a questionnaire to measure the elements of hunting satisfaction spanned 8 months, including many brainstorming sessions and pre-tests on hunters and nonhunters alike. It seemed apparent that there are many different satisfactions, and our contact both within and outside the hunting culture was necessary to develop a comprehensive list. A final list of 73 questionnaire items described possible elements of hunting satisfaction. Each hunter was asked to indicate the extent to which each element *added to* or *detracted from* his personal hunting satisfaction.[4] These responses were compiled on a 9-point Likert scale ranging from "extremely adds" to "extremely detracts." The elements of satisfaction included such items as "getting my limit," "being with my hunting companions," "at least seeing some game," "being close to nature," "getting away from home," "stalking game," "reading sportsmen's magazines," and so forth.

To identify dimensions of satisfaction, we combined conceptually related elements. The elements were grouped on the basis of obvious relationships, such as between the items "reading sportsmen's magazines" and "telling hunting stories and experiences." Both of these elements fell into a cluster we called the "vicariousness" dimension of satisfaction. To help sort elements with more subtle similarities, we performed a factor analysis on all 73 elements to examine our intuitive notions about which items might be related. The factor analysis helped us identify some items we had overlooked for certain dimensions.

Finally, to refine each dimension of satisfaction, we calculated item-to-item and item-to-average score correlations. We then eliminated items which had low predictive ability, thereby reducing the number of elements in each dimension by about half.[5] Individual

[4] A conceptual issue in the study of motivation (why people hunt) concerns what has been measured, i.e., perception or expectation of satisfaction, actual experience, or recollection of experience. We view these in a sequential model where the hunter perceives or expects certain conditions, and then experiences a hunt which may be influenced by expectations. Afterwards he recalls the experience and formulates new expectations for the coming year. We assume that measurement of motivation is based upon both recollection and expectation. It is these two concepts that help guide hunters' decisions about future hunting activity.

[5] Gamma statistic was used to indicate the degree of association between individual items and dimension scores. Gamma indicates the proportional reduction in error from predicting rank order responses to one variable from rank order knowledge of a second, compared to predictions made at random (Costner 1965; Goodman and Kruskal 1954).

TABLE 1.—DIMENSIONS OF HUNTING SATISFACTION[1]

	Item-to-average score correlation Gamma
1. NATURE--elements of the hunting experience related to the out-of-doors and appreciation of nature:	
Being close to nature	0.89
Just being outdoors	0.84
The smell and sound of the woods and field	0.83
Getting away from civilization	0.82
Camping out while hunting	0.78
At least seeing some wildlife	0.69
2. ESCAPISM--items implying a search for a change of daily routine, or escape from the pressing demands of civilization:	
Getting away from everyday problems (job, family, etc.)	0.79
Getting away from civilization	0.79
Getting away from home	0.72
Seeing very few other hunters while hunting	0.60
3. COMPANIONSHIP--desire for social contact with hunters in one's own party:	
Being with my hunting companions	N.A.[2/]
4. SHOOTING--the act of shooting typifies this dimension:	
Shooting my gun	0.75
At least getting some shots	0.71
Seeing game fall as I shoot	0.71
Making a difficult shot	0.69
5. SKILL--items related to aspects of hunting where use of one's knowledge, ability, or cunning contributes to hunting satisfaction:	
Making a difficult shot	0.72
Outsmarting game	0.72
Stalking game	0.71
Being thought of as a skilled hunter	0.65
Bagging more game than hunters in other parties	0.65
Teaching someone else the skills of hunting	0.64
Bagging as much game as my hunting companions	0.63
6. VICARIOUSNESS--elements of hunting not dependent on direct participation. These may be thought of as offsite enjoyment related to hunting:	
Hunting movies or TV programs	0.84
Reading sportsmen's magazines	0.78
Telling hunting stories and experiences	0.74
7. TROPHY-DISPLAY--items related to showing or displaying game to demonstrate one's success or skill:	
Showing game I bagged to family and friends	0.83
Bagging a very large animal or bird	0.81
Bringing game home	0.80
Displaying game while going home	0.70
Saving hides, horns, or feathers	0.66

TABLE 1.—DIMENSIONS OF HUNTING SATISFACTION (CON.)

	Item-to-average score correlation Gamma
8. HARVEST--aspects of the hunt related to bagging or possessing game:	
Getting my bag limit	0.86
The amount of game bagged	0.84
Bagging as much game as my hunting companions	0.81
Bagging more game than hunters in other parties	0.80
Bringing game home	0.75
9. EQUIPMENT--satisfactions based on owning, maintaining, using or comparing one's equipment with others:	
Being a well-equipped hunter	0.82
Having the best of hunting equipment	0.82
Cleaning and maintaining my hunting equipment	0.75
Comparing my equipment with other hunters'	0.70
Collecting guns	0.60
10. OUTGROUP VERBAL CONTACT--effect on satisfaction of talking with hunters outside one's own party:	
Talking with hunters in other parties	N.A.[2/]
11. OUTGROUP VISUAL CONTACT--effect on satisfaction of seeing hunters outside one's own party:	
Seeing hunters from other parties	N.A.[2/]

[1/] Based on obvious relationships and statistical criteria several items were included in more than one dimension.

[2/] Only one item each from the questionnaire was a suitable description of companionship, outgroup verbal and outgroup visual contact.

hunter scores for each dimension were calculated by averaging the responses to all elements in each dimension. These indicate the degree of satisfaction each hunter felt on each dimension and how his scores compared to all of the other hunters.'

RESULTS AND DISCUSSION

Dimensions of Hunting Satisfaction

Eleven dimensions of hunting satisfaction emerged from the described process. These dimensions and the elements included in each one are shown in Table 1.

The distribution of average scores for each dimension of satisfaction is shown in Table 2. The 11 dimensions are arrayed in the descending order of overall importance assigned to them by hunters surveyed.

These data support the proposition that hunting satisfaction is complex and consists of many aspects of the experience other than simply harvesting game.[6] Some dimensions of satisfaction are clearly

[6] That there is more to hunting than harvesting game has been expressed by many scientists and authors. For review of intangible values of hunting see Hendee (1969), More (1970), Hendee and Potter (1971).

TABLE 2.—DISTRIBUTION OF HUNTER SCORES FOR THE DIMENSIONS OF HUNTING SATISFACTIONS

Dimension	Satisfaction						Total number[1]	Scale reliability[2]
	Extremely adds	Highly adds	Moderately adds	Somewhat adds	Neither adds nor detracts	Detracts		
	Percent and cumulative percent[3]							
Nature	36.1	42.5 (78.6)	15.7 (94.3)	4.2 (98.5)	1.0 (99.5)	0.6 (100.1)	4,861	0.82
Escapism	15.1	34.9 (50.0)	31.7 (81.7)	14.2 (95.9)	3.6 (99.5)	0.4 (99.9)	5,071	0.63
Companionship (ingroup)	26.9	27.0 (53.9)	20.8 (74.7)	11.6 (86.3)	10.6 (96.9)	3.1 (100.0)	5,148	N.A.[4]
Shooting	7.0	23.9 (30.9)	36.4 (67.3)	24.8 (92.1)	7.2 (99.3)	0.8 (100.1)	5,034	0.63
Skill	2.2	19.5 (21.7)	44.3 (66.0)	27.6 (93.6)	5.8 (99.4)	0.6 (100.0)	4,925	0.74
Vicariousness	3.2	15.9 (19.1)	30.8 (49.9)	33.8 (83.7)	14.8 (98.5)	1.4 (99.9)	5,010	0.61
Trophy-display	3.0	14.2 (17.2)	31.8 (49.0)	35.0 (84.0)	14.8 (98.8)	1.2 (100.0)	5,069	0.77
Harvest	3.5	12.6 (16.1)	27.3 (43.4)	34.9 (78.3)	20.4 (98.7)	1.3 (100.0)	4,987	0.83
Equipment	2.4	11.3 (13.7)	30.5 (44.2)	34.7 (78.9)	20.0 (98.9)	1.0 (99.9)	5,008	0.73
Outgroup verbal contact	6.1	8.3 (14.4)	20.5 (34.9)	24.3 (59.2)	30.1 (89.3)	10.8 (100.1)	5,126	N.A.[4]
Outgroup visual contact	3.8	4.6 (8.4)	13.8 (22.2)	13.6 (35.8)	30.3 (66.1)	33.9 (100.0)	5,136	N.A.[4]

[1] Variation in number is due to nonresponse to some questionnaire items.

[2] Scale reliability is calculated from the formula $r_{tt} = \frac{n\bar{r}}{1 + (n-1)\bar{r}}$ where n = number of items and $\bar{r}$ = average intercorrelation among items (Nunnally, 1967).

[3] Variation from 100 in the cumulative percent of the Detracts column is due to rounding.

[4] Not applicable because scores were based upon a single item.

more important than others in terms of the number of hunters positively responding to them. In particular, nature, escapism, and companionship appear far more important than the other eight dimensions—shooting, skill, vicariousness, trophy-display, harvest, equipment, talking to and seeing outsiders.

It is important to note that the majority of hunters endorse all of the dimensions of satisfaction except "outgroup visual contact" as contributing at least somewhat to their satisfaction. On the other hand, 15-30 percent indicate that the vicariousness, trophy-display, harvest, equipment, outgroup verbal, and outgroup visual dimensions neither added to nor detracted from hunting satisfaction.

Hunters clearly distinguish between social interaction within their group and contact with outsiders. "Companionship" (ingroup) was the third most important dimension of satisfaction, but verbal and visual contacts with people outside one's hunting party were at the bottom of the list. In fact, one-third of the hunters said "outgroup visual contact" detracted from their satisfaction.

Clearly, hunting satisfaction consists of many dimensions. Most important, although hunters presumably go to the field in search of game, they find many associated experiences and satisfactions more important than the harvest itself. It is this total package of recreational satisfaction that provides a positive rationale for sport hunting and distinguishes it from killing (Hendee and Potter 1971).

Variation by Kinds of Hunters

There were both similarities and differences in the way different kinds of hunters scored on the various dimensions of satisfaction.[7] Some dimensions of satisfaction seem *generic* to all kinds of hunting; others are more *specific* to particular kinds of hunting (Figure 1). All kinds of hunters responded similarly to the seven generic dimensions —nature, escapism, companionship, shooting, harvest, outgroup verbal and outgroup visual contact. But different kinds of hunters varied more in the importance they attached to the specific dimensions—skill, vicariousness, trophy-display and equipment.

Generic satisfactions, although common to all hunting, may vary in *form* and *intensity* from one kind of hunting to another. For example, "shooting" is a dimension of satisfaction generic to all hunters; but although a big-game hunter may be satisfied with only a few shots per

[7] We classified hunters by their answers to a question asking what *kind of hunting* they most preferred (for upland birds, waterfowl, small game, deer, elk, and other big game). For most hunters, their stated preference corresponded with the kind of hunting to which they had devoted the most days in the previous year. In cases where days of hunting and preference did not correspond, we assumed that preference was more predictive of the hunters' psychological set.

Figure 1.—Generic and specific satisfactions from hunting

Generic satisfactions (Important to all kinds of hunting, but form and intensity may vary)	*Specific Satisfactions* (Importance as well as form and intensity varies with kind of hunting)
Nature	Skill
Escapism	Vicariousness
Companionship	Trophy-Display
Shooting	Equipment
Harvest	
Outgroup verbal	
Outgroup visual	

year, a duck hunter may require many shots each day to satisfy this dimension. "Harvest" is a generic satisfaction; however, big-game hunters may be satisfied with only one kill (or less) per year whereas bird hunters require considerably more.

By contrast, "skill" is a specific dimension because it is more important to big-game and waterfowl hunters than to others. This suggests the need for conditions allowing the expression of "skill" in these kinds of hunting, such as chances for stalking deer as well as road hunting, and opportunity for decoying and calling ducks as well as pass shooting on a firing line.

The variation of the four *specific* dimensions of satisfaction—skill, vicariousness, trophy-display, and equipment—warrants some discussion. All kinds of hunters place some importance on skill as a dimension of satisfaction, but a significantly higher proportion of big-game hunters say skill plays a major part in their satisfaction. The other three specific dimensions—vicariousness, trophy-display, and equipment—also are somewhat important to most hunters, but their importance generally is heightened as probability of bagging game decreases. For example, vicariousness or offsite enjoyment is most important to big-game hunters. Thus, we propose that telling stories, reading magazines, and viewing hunting movies or television programs becomes an important supplement to action in the field when the probability of success or of seeing game declines.

Big-game hunters also scored well above others on trophy-display. This suggests that showing off one's "catch" or otherwise displaying evidence of success may be particularly important for hunting when the probability of harvest is low. A logical explanation is the heightened prestige of showing off a trophy that is difficult to bag.

Finally, owning and using hunting equipment is most satisfying to big-game hunters. Here again, comparison, maintenance, and use of equipment seems more important as a supplemental satisfaction for the hunter whose probability of success is relatively low.

Variation by Hunter Characteristics

Key demographic variables including age, education, income, sex, and place of residence do not appear in general to affect the importance a hunter attaches to the different dimensions. Neither are there important differences in satisfaction scores that can be explained by hunting experience or by increasing or decreasing interest in hunting.

However, when each kind of hunting was examined separately, satisfaction scores clearly were related to certain hunter characteristics. While space does not permit a detailed description of these findings, their importance should be noted. Just as the dimensions of satisfaction take on various forms and intensity for different kinds of hunting in general, certain hunters within those groups are even more discriminating in terms of the satisfactions they derive from their particular brand of hunting.

IMPORTANT MANAGEMENT IMPLICATIONS

We think that the results of this research hold important clues to ways in which wildlife managers can optimize the many satisfactions gained from hunting. First, these data imply why people hunt. As was pointed out in the 1970 National Survey of Fishing and Hunting, sport hunting has many rewards (U.S. Bureau of Sport Fisheries and Wildlife 1972). We should not perpetuate policies that focus solely on harvest as the principal product of hunting or on man-days of recreaction without regard to quality. It is clear that hunter satisfaction is complex and consists of many dimensions, several of which are more important to most hunters than bagging game. The expectation of success is necessary, but by itself, it is insufficient to produce quality hunting experiences.

Second, the multiple-satisfaction approach makes it possible to define a quality hunting experience. Quality hunting results when hunters experience their desired dimensions of satisfaction, including a reasonable probability of success. Quality is improved to the extent that satisfactions can be derived in their preferred form and intensity for particular kinds of hunting. Quality hunting provides all the satisfactions which generally define a particular kind of hunting, with diversity available to match specific individual desires for a broad range of hunters.

Third, managers must perceive the form and intensity these dimensions of satisfaction take for different kinds of hunting, and then act to maintain and increase them. Such generic dimensions as nature, escapism, and shooting are important to all hunters, but the form

those dimensions take may vary widely with different kinds of hunting. Likewise, specific satisfactions, such as skill, trophy-display, and equipment, take different forms according to the kinds of hunting. In other words, the fact that all kinds of hunters similarly weight a dimension such as shooting does not imply they are talking about identical experiences.

Hunting, like other outdoor activities, offers a variety of satisfactions and a continuum of opportunities in various forms and intensities. Under haphazard or *laissez-faire* management, this diverse range of satisfactions is likely to disappear. Deliberate management is needed to preserve opportunities for a full complement of those experiences that characterize quality hunting of the different kinds, each of which attracts a different kind of hunter.

Finally, the growth of hunting, coupled with relatively little potential for change in the amount of game and land available, indicates that the numbers of hunters will have to be managed carefully—perhaps limited to maintain opportunities for quality hunting of whatever kind. The multiple satisfaction model indicates that the capacity to provide hunters with the satisfactions they seek may decline before either the amount of game or sheer physical space becomes a limiting factor. Thus, in the future, management for people in a much broader context will become an increasingly important element of game management.

LITERATURE CITED

Costner, Herbert L.
1965. Criteria for measures of association. Am. Sociol. Rev., 30(3): 341-353.

Goodman, Leo A. and William H. Kruskal.
1954. Measures of association for cross classifications. J. Am. Stat. Assoc. 49(268): 732-764.

Hendee, John C.
1969. Appreciative versus consumptive uses of wildlife refuges: studies of who gets what and trends in use. Trans. 34th North Am. Wildl. Nat. Resour. Conf. 34: 252-264.

———.
1973. A multiple-satisfactions approach to game management. Manuscript in publication process. 12 p. typewritten.

——— and Dale R. Potter.
1971. Human behavior and wildlife management: needed research. Trans. 36th North Am. Wildl. Nat. Resour. Conf. 36:383-396.

More, Thomas Alastair.
1970. Motivational attitudes of licensed Massachusetts hunters. M.S. Thesis, Univ. Mass. 50 p., illus.

Nunnelly, Jum C.
1967. Psychometric theory. Chap. 6, "Theory of measurement error," pp. 172-205. New York: McGraw-Hill.

Potter, Dale R., Kathryn M. Sharpe, John C. Hendee, and Roger N. Clark.
1972. Questionnaires for research: an annotated bibliography on design, construction, and use. U.S. Dep. Agric. For. Serv. Pac. Northwest For. Range Exp. Sta. Res. Pap. PNW-140, 80 p.

U.S. Bureau of Sport Fisheries and Wildlife.
1972. 1970 National survey of fishing and hunting. U.S. Dep. Inter. Bur. Sport Fisheries Wildl. Serv. Resour. Publ. 95, 103 p., illus.

ATTITUDES OF MASSACHUSETTS HUNTERS[1]

THOMAS A. MORE
School of Natural Resources, University of Michigan, Ann Arbor, Michigan

It has been suggested that recreation for the individual is an experience: a state of mind rather than just participation in an activity (Driver and Tocher 1970). If so, recreation resource management must be concerned not only with the quantity of experiences provided, but also with their quality (Webb 1968). In the case of hunting, management for quality implies the need to understand the factors that motivate the behavior of hunters.

There has been a range of motives attributed to sport hunters and much debate over the moral and ethical aspects of killing for pleasure (Anthony 1957; Krutch 1957). However, Hendee and Potter (1971) have argued that there is a need to examine the relationship between success and satisfaction in hunting. This suggests that satisfaction may depend upon more factors than the amount of game harvested. Understanding some of these could lead to better management for quality hunting experiences. This paper reports the results of a study in Massachusetts that attempted to measure the motivational incentives involved in hunting.

METHOD

In the fall of 1969 a questionnaire was mailed to a systematic sample of hunters selected for a previous study (Sendak and Bond 1970) from the population of hunters licensed by Massachusetts in 1964. The total sample was 618 and 69.5 percent were returned. Of these, 325 were usable in the analysis.

The questionnaire contained 52 statements about reasons for hunting ("I enjoy hunting because . . ."). Some were included because they had been shown to express values important to wilderness users (Hendee *et al.*, 1968), while others, especially those about taking game, were unique to hunting. Hunters responded to each statement on a five-point scale and the responses were weighted (one for "strongly disagree," two for "disagree," three for "uncertain," four for "agree," and five for "strongly agree").

RESULTS

A principal components factor analysis was performed on the data (Cooley and Lohnes 1962). This technique reduces the number of

[1] This research was supported by Northeast Regional Research Project N. E. M.-35 and conducted while the author was a graduate student, Department of Forestry and Wildlife Management, University of Massachusetts, Amherst, Massachusetts.

variables by grouping them into new variables called factors. A factor loading represents the correlation between the original variable and the new factor. Although all variables load on each factor, only those variables with loadings greater than 0.30 on a particular factor were considered significant in defining that factor.

Seven independent factors were obtained from the analysis. The factors (one through seven, respectively) were named "Display," "Aesthetics," "Affiliation," "Pioneering," "Kill," "Exploration," and "Challenge" based upon the content of the statements appearing in them. Each factor was also classified as positive if the grand mean of responses to statements in the factor indicated that hunters agreed with those statements, negative if the hunters disagreed, or neutral if the grand mean was not strongly positive or negative. Because of space limitations, only the positive and negative factors are presented in tabular form.

The positive and negative factors are "Aesthetics" (Table 1), "Affiliation" (Table 2), "Exploration" (Table 3), and "Challenge" (Table 4). These factors indicate that, as a group, the Massachusetts hunters studied were motivated to avoid the more overt signs of civilization and concentrate on the aesthetic aspects of nature. They enjoyed the company of other hunters and there was some slight indication of a preference to hunt in familiar environments as opposed to exploring new areas—perhaps a manifestation of the "home range" concept (Thomas et al. 1973). In addition, the "Challenge" factor

TABLE 1. FACTOR TWO: AESTHETICS (GRAND MEAN = 3.86, POSITIVE RESPONSE)

Attitude	Factor Loading	Mean	Standard Deviation
Solitude and isolation	0.64	4.06	0.824
Watching nongame wildlife	0.62	4.25	0.660
Looking at scenery	0.58	4.31	0.593
Being out in the fields and forests	0.58	4.58	0.568
Tranquility of nature	0.56	4.37	0.588
Getting away from the city	0.51	3.44	1.099
Avoiding signs of civilization	0.50	4.18	0.930
Breathe fresh air	0.49	4.06	0.813
Get away from people	0.41	2.81	1.154
Relax and relieve tensions	0.38	4.31	0.642
Fall weather	0.32	3.44	0.886

TABLE 2. FACTOR THREE: AFFILIATION (GRAND MEAN = 3.39, POSITIVE RESPONSE)

Attitude	Factor Loading	Mean	Standard Deviation
Getting out with friends	0.70	3.56	0.999
Fellowship with other men	0.68	3.84	0.944
Chatting with strangers	0.48	3.80	0.744
Friends also hunters	0.40	2.44	1.093

TABLE 3. FACTOR SIX: EXPLORATION (GRAND MEAN = 2.63, NEGATIVE RESPONSE)

Attitude	Factor Loading	Mean	Standard Deviation
Getting away from home	0.68	2.83	1.140
Taking small risks	0.49	2.15	1.111
Exploration	0.42	3.00	1.173

TABLE 4. FACTOR SEVEN: CHALLENGE (GRAND MEAN = 3.67, POSITIVE RESPONSE)

Attitude	Factor Loading	Mean	Standard Deviation
Man's mind vs. natural cunning and sharp senses of the animal	0.58	3.93	0.861
Passing up small animals for even a remote chance for a larger one	0.57	3.56	1.050
Practicing woodsmanship skills	0.52	3.82	0.045
Pitting self against the elements	0.48	3.50	0.971
Tracking and stalking game	0.42	4.09	0.719
Nostalgia	0.42	3.59	1.082
Telling tall tales	0.41	3.39	1.131
Getting physically tired	0.37	3.64	0.985

shows that the hunters enjoyed aspects of the hunt like tracking and stalking game, and practicing woodmanship skills—activities which precede, and may eventually result in the actual taking of game.

The three neutral factors were "Display," "Pioneering," and "Kill." "Display" (grand mean = 3.14) included: displaying guns in the home; displaying trophys in the home;; photographing areas hunted in; and shooting guns. "Pioneering" (grand mean = 3.04) contained attitudes like: low cost recreation; recapture the pioneer spirit; simple living; self-sufficiency; manliness; physical exercise; and adventure. "Kill" (grand mean = 3.09) included: enjoy shooting game; disappointed at missing a shot; expect to shoot game; disappointed at coming home emptyhanded; competition with friends; success gives sense of satisfaction; success gives sense of personal importance; chance to test markmanship kill; and excitement. Means, standard deviations, and factor loadings for the statements in the neutral factors are reported in More (1970).

The neutral factors are more difficult to interpret than the positive and negative factors. Although the grand means showed no strong trend in either direction, the standard deviations of the individual items were large. This may be partially due to response bias, especially in statements about killing game. As this has been subjected to criticism, possibly some respondents sought to protect hunting's image (or their own self-image) by responding negatively about a positively held attitude.

An alternative interpretation is that these factors apply differently

to various hunter types. For example, the actual kill might be more important to upland game bird hunters than to hunters.

DISCUSSION

Why do men engage in hunting as a form of recreational behavior? Apparently there are several motivational incentives that operate simultaneously on Massachusetts hunters.

Hunting and fishing have been described as "consumptive" uses of wildlife as opposed to "appreciative" uses like camping, hiking, and nature study (Hendee 1969). However, Hendee and Potter (1971) have proposed that there are also appreciative aspects of hunting in addition to consumptive aspects. The aesthetic and affiliative factors found in this study support this. In fact, the strong aesthetic factor is held in common by hunters and wilderness users (Hendee *et al.* 1968; Shafer and Meitz 1969).

Yet, it is the act of physically consuming wildlife that distinguishes hunting from the other "appreciative" uses. Certainly, it is this act that has attracted the most attention and spurred the greatest controversy. Therefore, I believe it is important to place this act in a theoretical context.

It will be recalled that hunters responded more positively to statements defining the challenge factor than to those defining the kill factor. If we view the kill as a goal, then achieving this goal defines a problem for the hunter. The challenge factor contains elements that are important in the problem solving process: practicing woodsmanship, pitting self against the elements and against the cunning of the prey, and tracking and stalking game. For most hunters, the pleasure of sport hunting stems not from anything inherently rewarding about the death of an animal, but rather from the companionship of peers, the aesthetics of nature, and the application of their own skills in reaching the goal. The actual kill is an integral part of hunting because it provides the hunter with information that he has succeeded in solving the problem.

If this interpretation is correct, then hunting shares much in common with many other forms of recreation. For example, Catton (1970), citing Emerson, has suggested that this same process applies to mountain climbers: their goal is to reach the top, but the fun stems less from actually attaining the summit, than from carrying on the task in the face of uncertainty as to success. He then suggests that this same process motivates wilderness users, fishermen, and competitive game players.

Future research should concentrate on similarities and differences among the motives of hunters and those of other recreationists. If

these motivations are similar, as I suspect, then a real question is not what motivates the hunter, but rather how he comes to have goals that involve the physical consumption of wildlife—a question more appropriate for theories of learning than for theories of motivation.

In conclusion, I suggest that the pleasure of hunting comes more from the *process* than from the *product*. The product (success) is necessary, however, because it supplies the logical end of the process. In the words of the Spanish philosopher Ortega y Gasset (1972, p. 110): "One does not hunt in order to kill; on the contrary, one kills in order to have hunted."

LITERATURE CITED

Anthony, Harold E.
1957. The sportsman or the predator: Part II. but it's instinctive. Saturday Rev. Lit. 40:9-10,40. Aug. 17.

Catton, William R.
1970. Motivations of wilderness users. Trends in Parks. p. 9-17. Oct.

Cooley, William W., and Paul R. Lohnes.
1962. Multivariate procedures for the behavioral sciences. John Wiley and Sons, Inc., New York. 211 p. illus.

Driver, B. L., and S. Ross Tocher.
1970. Toward a behavioral interpretation of recreation with implications for planning. In: B. L. Driver (ed.) Elements of outdoor recreation. University Microfilms, Ann Arbor, Mich. p. 9-31.

Hendee, John C.
1969. Appreciative versus consumptive uses of wildlife refuges: Studies of who gets what and trends in use. Trans. 34th N. Amer. Wildlife and Natur. Resour. Conf. 34:252-264.

Hendee, John C., Catton, William R., Marlow, Larry D., and C. Frank Brockman.
1968. Wilderness users in the Pacific Northwest: Their characteristics, values and management preferences. U.S.D.A. For. Serv. Res. Pap. PNW-61. Pacific Northwest Forest and Range Expt. Sta., Portland, Ore. 92 p. illus.

Hendee, John C., and Dale R. Potter.
1971. Human behavior and wildlife management: needed research. Trans. 36th N. Amer. Wildlife and Natur. Resour. Conf. 36:383-396.

Krutch, Joseph Wood.
1957. The sportsman or the predator: Part I. A damnable pleasure. Saturday Rev. Lit. 40:8-10, 39, 40. Aug. 17.

More, Thomas A.
1970. Motivational attitudes of licensed Massachusetts hunters. M. S. thesis, Univ. Massachusetts, Amherst. 50 p. illus.

Ortega y Gasset, Jose.
1972. Meditations on hunting. Charles Scribner's Sons, New York. 152p. illus.

Sendak, Paul E., and Robert S. Bond.
1970. A consumer analysis of licensed hunters and fishermen in Massachusetts. Planning and Res. Develop. Ser. No. 14, Bull. No. 583. Holdsworth Natural Resources Center, Agr. Expt. Sta., Univ. of Mass., Amherst. 43p. illus.

Shafer, Elwood L., and James R. Meitz.
1969. Aesthetic and emotional experiences rate high with Northeast wilderness hikers. Environ. and Beh. 1:187-197.

Thomas, Jack Ward, James C. Pack, William M. Healy, John D. Gill, and H. Reed Sanderson.
1973. Territoriality among hunters—The policy implications. 38th N. Amer. Wildlife and Natur. Resour. Conf. 38:274-280.

Webb, William L.
1968. Public use of forest wildlife: quantity and quality considerations. J. Forest. 66(2):106-110.

RELATIONSHIPS BETWEEN HUNTING SUCCESS AND SATISFACTION[1]

GEORGE H. STANKEY AND ROBERT C. LUCAS
USDA Forest Service, Intermountain Forest and Range Experiment Station, Missoula, Montana; and

ROBERT R. REAM
School of Forestry, University of Montana, Missoula, Montana

INTRODUCTION

In the United States game management objectives traditionally have focused on the maximization of game numbers using such programs as transplanting and habitat improvement (ORRRC 1962). This was a logical orientation, based on the assumption that success (game bagged) was the principal source of hunter satisfaction. The concept that sport hunting provides a wide range of human satisfactions and benefits that are independent of or only indirectly linked to success has received only limited attention (Crissey 1971).

Certain trends indicate the traditional "game bagged" concept of hunting satisfaction will become more difficult to fulfill. Generally, it appears we can expect to see increased hunting pressures on game species and reduced habitat, so as a result, success ratios should decline. In light of these forces, our traditional beliefs about the relationship between hunting success and satisfaction need to be re-examined.

We need to develop more adequate concepts as to what constitutes quality hunting (Ream 1972) and how variations in quality affect the character of satisfactions derived by hunters. As Wagar (1966) points out, quality is a human concept, dependent upon the fulfillment of needs. Thus, in attempting to describe hunting quality, we are trying to characterize those aspects of hunting that fulfill certain needs and motivations. Quality definitions are certainly varied and dynamic (Mohler 1972). However, if we carefully articulate those elements that constitute quality in sport hunting, we can better prescribe management objectives that will insure satisfaction.

The number of animals harvested has been a traditional measure of management success. However, under increasing use pressure, a "days afield" model of hunting satisfaction has gained support (Crissey 1971). Under this concept, an increased number of hunters in the field is seen as producing an increased amount of satisfaction. There is an implicit assumption of a constant quality per unit undergirding this concept, raising the possibility that management

[1]The financial support of the Natural Environments Program, Dr. John V. Krutilla, Director, at Resources for the Future, Inc., Washington, D. C., is gratefully acknowledged.

might tend to emphasize programs that maximize participation at the expense of programs providing diversity in the quality of experience (Webb 1968).

We know little about what hunters seek, apart from some intuitive and untested notions. We know even less about how satisfaction is linked to "game in the bag." Some studies have reported on hunter estimations of satisfaction (e.g., Nobe and Gilbert 1970; Garrett 1970; Kirkpatrick 1965), but in most of these satisfaction has been examined only in relation to game or hunting conditions as is pointed out by Hendee and Potter (1971). Other values, such as health, esthetics, challenge, or so forth, have been investigated only in a few studies.

RESEARCH ISSUES

Two contrasting hypotheses regarding the role of success can be defined. In the first, success is the dominant source of satisfaction. The seeming paradox of declining success ratios and growing numbers of hunters is resolved by arguing that success ratios have not yet dropped to some unspecified threshold where hunters stop hunting. In an alternative hypothesis, success is only one of a multiple set of satisfactions derived from hunting (Potter, Hendee, and Clark 1973).

Within the framework of these alternative hypotheses, we set up a study in which we sought answers to the following questions. (1) What role does success, defined as the taking of an animal, play in definitions of hunting quality? (2) How does the relative significance of success vary between successful and unsuccessful big game hunters and between different types of successful hunters? (3) How does success, or the lack of it, affect the choice of a future hunting location?

STUDY METHODS

Names and addresses for more than 1,000 hunters were obtained at field check stations on four major access roads to the Sapphire Mountains, south of Missoula, Montana, during the fall hunting season in 1971. From these, a systematic sample of 540 hunters was mailed an 8-page questionnaire. After using one follow-up reminder, 418 useable responses were obtained (77 percent response).

Hunting success for both deer and elk in the Sapphire area had varied considerably in the past. In a 14-year period (1958-1971), an annual average of 750 deer hunters took 359 animals (a success ratio of 48 percent). However, success ratios ranged from 85 percent to 19 percent; in the last three years, they averaged only 31 percent. Elk hunting has shown a similar pattern. Over the 14 years, an annual average of 788 hunters took 175 animals a year (a 22 percent success

ratio). In the last three years, the success ratio declined to an average of only 11 percent. The recent declines in these success ratios appear related to an increase in the number of hunters rather than a decline in herd numbers.[2]

In an open-ended question, hunters were asked "In your own words, what does 'quality big game hunting' mean to you?" Up to three responses per individual were tabulated and grouped into the following intuitively similar categories:

1. *Success-dependent.* Responses included such statements as "meat for the freezer," "getting a trophy buck," and "getting an animal."
2. *Game-dependent.* Responses were distinguished from success-dependent responses by lack of specific reference to success, such as "chance to see game," "game sign," and the presence of a "well-managed game population."
3. *General outdoor enjoyment.* Responses suggested respite from normal day-to-day affairs, such as "exercise," "getting away from it all" and "a chance to see wildlife, not necessarily game species."
4. *Environmental amenities.* Responses were primarily related to physical characteristics of the area such as "natural," "unmodified," and "lack of human developments."
5. *Non-mechanized access.* Responses related to the access to the hunting area, such as "no roads" and "foot travel only."

As shown in Table 1, over two-thirds of 402 hunters gave reasons related either to the *success-* or *game-dependent* categories or to both. Such reasons are closely related, therefore, responses assigned to the *game-dependent* category might have simply reflected different expressions of success. When viewed together, the frequency of these responses provides some insight on the shortcoming of "days afield" as a measure of hunting satisfaction. Obviously, taking or seeing an animal is clearly a dominating focus in hunter definitions of quality and continued dilution of the probability of success will lead to a decline in satisfaction levels.

However, the hunter's definitions of quality definitely indicate that aspects other than game are important. Responses that were assigned to the combined *general outdoor enjoyment* and *environmental amenities* categories were cited by about one-third of the hunters; thus, for a significant minority of hunters, quality hunting suggests the opportunity for escape from the turmoil of everyday life. Furthermore, the character of the hunting landscape is an important component of such quality. Although hunters might believe there is some relationship

[2]Derived from unpublished figures by the Montana State Fish and Game Department.

between environmental quality and the probability of hunting success, this dimension of hunting quality appears conceptually independent of success. Furthermore, the successful and unsuccessful hunters responded in much the same ways (chi-square was only 1.39 with 2 degrees of freedom, insignificant at the 0.95 level). This appeal of the natural environment for hunters was documented by More (1970).

In the nonmechanized access category, there was considerable range in terms of the number of hunters citing reasons related to it. Only about one in ten of the unsuccessful hunters mentioned such reasons as compared to one out of four of the successful elk hunters. Forty-four percent of the unsuccessful hunters "road hunted" most or all of the time as compared to one-fourth of the successful hunters. Eighty-three percent of the successful elk hunters indicated they either never or only occasionally "road hunted."

Two conclusions can be drawn from these data. (1) Success represents a major component of quality; thus, when designing programs to provide satisfactory hunting experiences, we need to insure hunters some reasonable expectation of success. Management

TABLE 1. PERCENTAGE VARIATIONS IN DEFINITION OF HUNTING QUALITY BY SUCCESS[1]

Item	No. hunters	Success-dependent	Game dependent	General outdoor enjoyment	Environmental amenities	Non-mechanical access
Unsuccessful	305	29	65	14	21	11
Successful deer	68	29	62	12	26	16
Successful elk	29	48	66	21	21	24
Average		30	64	14	21	13

Chi-square = 5.86, 8 d.f., insignificant at .95 level.

[1]Up to three answers were coded for each respondent; therefore, row totals exceed 100 percent.

programs that emphasize other returns (e.g., man-days of recreation) at the expense of insuring some minimum probability of success, should be discouraged. (2) The definitions of hunting quality (Table 1) showed no statistically significant differences either between successful and unsuccessful hunters or between successful deer and successful elk hunters. The appeals of quality big game hunting appear to have a broad, generic base that is independent of the individual's particular record of success, at least in the short run.

AREA QUALITY, SUCCESS, AND FUTURE HUNTING BEHAVIOR

Sixty-five percent of the hunters surveyed had previously hunted in the Sapphires. This prior experience was positively associated with success; 31 percent of the returning hunters were successful in 1971

as compared to 18 percent of the newcomers (This difference is significant at the 0.95 level).

A majority of the respondents perceived that the quality of hunting was declining in the Sapphire Mountains; 62 percent of the unsuccessful hunters and 51 percent of the successful hunters. However, the reasons cited for this decline varied. Forty-eight percent of the unsuccessful hunters and 42 percent of the successful deer hunters as compared to 18 percent of the successful elk hunters attributed the decline to dwindling game populations. On the other hand, increasing numbers of hunters was cited by 19 percent of the unsuccessful hunters as compared to 32 and 36 percent of the successful deer and elk hunters, respectively. Similarly, only 13 percent of the unsuccessful hunters mentioned excessive road development as the problem as compared to the 23 and 36 percent of the successful deer and elk hunters. Thus, while unsuccessful hunters placed predominant emphasis on "fewer animals" as a reason for declining quality, successful hunters—especially elk hunters—tended to perceive a variety of influences not only related to game numbers, but also to hunting pressure and road development. Unsuccessful hunters appear to view success as primarily a matter of supplying adequate game numbers, irrespective of hunting pressure, access, and habitat condition. Successful hunters seem to more fully recognize the interrelationships between these variables.

One manifestation of hunting satisfaction is an expression of intent to hunt the same area in the future.[3] About 60 percent of the unsuccessful hunters indicated they either "weren't sure" or definitely would not hunt the Sapphires the following year. One-third of the successful hunters did not plan to return to the Sapphires; this suggests that success is not the only factor determining satisfaction.

Those hunters indicating they would hunt elsewhere were asked to specify why they did not plan to hunt the Sapphires again as well as what characteristics of another location were perceived as making it a desirable alternative. Forty-five percent of the unsuccessful hunters cited the lack of adequate game numbers and poor hunting as reasons for leaving the Sapphires. No discernible pattern could be detected for successful hunters.

Preference for the character of access in alternative hunting locations was a distinguishing characteristic between successful and unsuccessful hunters. Only 11 percent of the unsuccessful hunters indicated "fewer roads" and "less accessible" as reasons for choosing

[3] We recognize many hunters derive considerable satisfaction from a "searching" or "exploratory" kind of behavior that permits them to see new country each season. However, the decision to hunt in a different area in the future is one possible expression of hunter dissatisfaction.

another location, but 40 percent of the successful hunters noted these characteristics. Thus, excessive road development and attendant problems of easy access (increased hunting pressure, road noise, harrassment of animals) appear to be important criteria against which successful hunters judge desirable hunting areas.

CONCLUSIONS

Success, defined as the taking of an animal, constitutes a significant component of a satisfactory hunting experience, at least within the particular big game hunting group surveyed. As success ratios decline, those satisfactions dependent on a successful hunt will diminish. Although the significance of other satisfactions might be heightened in the face of reduced probabilities of success, there is probably a threshold to the extent to which these satisfactions play a supplementary role.

Success-dependent satisfactions are probably largely nonsubstitutable. Consequently, management programs that insure some minimum probability of success should have high priority and should not be sacrificed at the expense of programs that provide satisfactions that can be obtained in other settings. The continued reliance on "days afield" as a measure of output without a subsequent effort to maintain reasonable expectations of success will lead to a decline in those satisfactions uniquely associated with hunting.

Although hunting success is a necessary variable in determining satisfaction, success alone is not sufficient. Success might be more accurately characterized as serving a "catalytic" function in that its presence or absence might influence both the type of additional satisfactions experienced by the hunter and their relative importance to him. In other words, satisfactions other than success-dependent might become especially significant as the hunter becomes satiated in his primary goal: getting an animal (Potter, Hendee, and Clark 1973).

Many hunters, both successful and unsuccessful, reported they would seek an alternative location to hunt the following season. Improved opportunities for success was a major reason cited by the unsuccessful hunters. However, it was not the only one, and for successful hunters, did not account for a majority of the reasons given. Success is only *one* outcome to which hunters aspire; satisfactions derived from esthetic enjoyment, solitude, sociability, challenge, and other aspects of the experience represent significant, and perhaps at times, superior returns to the individual. Thus, management strategies should emphasize a variety of settings that yield a mix of returns to the hunter. The general pattern of behavior for hunters seems to be

one that attempts to provide the individual with a broad set of satisfactory outcomes rather than one that simply tries to maximize one outcome, namely success. This type of behavior—striving only for "satisfactory" outcomes or in other words aiming for "good enough" instead of maximizing—has been termed a "satisficing" theory of human behavior by Simon (1957).

This behavior has important implications for game managers. To provide the wide mix of satisfactions hunters attribute to quality hunting, diverse management programs will be needed. Alterations in land management practices, variations in seasons, and the control of hunter numbers are examples of ways in which diversity can be achieved. For example, although some minimum level of access is necessary to permit sufficient harvest of game herds, we suspect that it has been reached already in most places. "Excess access" is probably leading to changes in traditional styles of hunting while opportunities to hunt elsewhere in these more traditional styles are dwindling. Closure of temporary logging roads, for example, might not only provide relief for animals harassed by continuous traffic but would also provide many hunters with an opportunity to derive satisfactions difficult to achieve in an area laced with roads (e.g., a quiet vigil at the head of a draw, etc.).

Hunters indicated that clearcut areas were not attractive hunting locations. While the "edge effect" and increased browse production in clearcuts can yield benefits to game, the kind of clearcuts common now have little appeal for hunters. However, small clearcuts interspersed with areas either uncut or selectively cut could provide not only desirable habitat for game, but a pleasing and interesting hunting landscape.

Wildlife managers will always be concerned with the production of wildlife populations, and rightfully so. However, the ultimate objective of resource management is the provision of human benefits. As we have discussed here, the ability to produce wildlife populations for harvest in sport hunting yields important human satisfactions that are dependent in varying degrees upon these populations. Understanding the nature of this dependence provides criteria by which issues of wildlife population production, habitat improvement and rationing might be resolved.

LITERATURE CITED

Crissey, Walter F.
1971. Some thoughts on wildlife research and management objectives. Wildl. Soc. News No. 184, pp. 27-28. (June).

Garrett, James R.
1970. Characteristics of Nevada Hunters. Agr. Exp. Sta. Bull. B22. Univ. Nev., Reno. 66 p., illus.

Hendee, John C. and Dale Potter
1971. Human behavior and wildlife management: needed research. *IN:* Thirty-Sixth N. Amer. Wildl. & Natur. Resources Conf. Trans., pp. 383-396.
Kirkpatrick, Thomas O.
1965. The economic and social values of hunting and fishing in New Mexico. Bur. Bus. Res., Univ. New Mex., 94 p., illus.
Mohler, Levi L.
1972. Thinking about quality. Idaho Wildl. Rev. 25: 3-6.
More, Thomas A.
1970. Motivational attitudes of licensed Massachusetts hunters. M.S. thesis, Univ. Mass. 50 p., illus.
Nobe, Kenneth C. and Alphonse H. Gilbert
1970. A survey of sportsmen expenditures for hunting and fishing in Colorado, 1968. Colo. Div. Game, Fish & Parks, Tech. Pub. No. GFP-R-T24. 93 p., illus.
Potter, Dale R., John C. Hendee, and Roger N. Clark
1973. Hunting satisfaction: game, guns or nature? Trans. Thirty-Eighth North Amer. Wildl. and Natur. Resources Conf. (In press).
Outdoor Recreation Resources Review Commission
1962. Hunting in the United States—its present and future role. Study Rep. 6, 117 p., illus.
Ream, Robert R.
1972. The relationships between logging and big game. *In:* Forest Land Use and the Environment (Richard M. Weddle, ed.), Mont. Forest and Cons. Exp. Sta., Univ. Mont. pp. 111-124, illus.
Simon, Herbert A.
1957. Models of man: social and rational. John Wiley, New York, 287 p., illus.
Wagar, J. Alan
1966. Quality in outdoor recreation. Trends in Parks and Rec. 3:9-12.
Webb, William L.
1968. Public use of forest wildlife: quantity and quality considerations. J. Forest. 66: 106-110, illus.

COLORADO HUNTER BEHAVIOR, ATTITUDES, AND PHILOSOPHIES[1]

BERNHARD J. SCHOLE
Cooperative Wildlife Research Unit, Colorado State University, Fort Collins;

FRED A. GLOVER
Vice President and Director of Research, Thorne Ecological Institute, Boulder, Colorado;

DOUGLAS D. SJOGREN
Director, Human Factors Research Laboratory, Colorado State University, Fort Collins; and

EUGENE DECKER
Assistant Professor, Wildlife Biology, Colorado State University, Fort Collins, Colorado

Research on hunters and hunting has been largely descriptive in scope and has dealt with such limited characteristics as age, income, success and expenditures. This study was designed to be an analytical investigation of hunters' behavior, attitudes, and rewards. Hendee and Potter (1971) emphasized the need for this type of research when they stated the basic products of wildlife management are human

[1] Contribution of the Colorado Cooperative Wildlife Research Unit; Colorado State University; Human Factors Research Laboratory, Colorado State University; Colorado Division of Wildlife; Wildlife Management Institute; Bureau of Sport Fisheries and Wildlife, cooperating.

satisfaction, and the overriding goals should be to produce desired and worthwhile human experiences.

This study gained insights about the reasons why people hunt. However, it should be recognized that identification of the "true" reason is as difficult in hunter research as other areas. Other topics discussed are how people become interested in hunting, what satisfactions they receive from hunting, and which experiences may affect their desire to continue hunting.

METHODS

A structured, one-hour interview was conducted with 400 Colorado hunters. The interview method was selected since it would yield the most reliable data on the type of information being collected (Gordon 1969).

The sample was selected at random from male Colorado hunters who purchased resident "sportsman" licenses in 1971. The 1971 sportsman license is a combination license which entitles the purchaser to pursue deer, elk, mountain lion, bear, small game, fish, and waterfowl. Sportsman license purchasers were selected on the assumption that they represent the most avid sportsman in Colorado, and therefore would give the best insights into the reasons why people hunt.

Three percent of the resident licenses sold in Colorado in 1971 were sportsman licenses. Those residents who do not purchase sportsman licenses are able to purchase separate licenses for deer, elk, and small game. Therefore, sportsman-license purchasers comprise somewhat more than three percent of Colorado resident hunters.

Information was gathered by personal interviews which included direct questions, open-ended questions, and rank-type responses. Analysis of results involved the comparison of hunter characteristics with variables relating to behavior, attitudes, philosophies, and interest in hunting.

RESULTS AND DISCUSSION

The average age of the Colorado sportsman-license purchaser was 37 years, with 51 percent more than 40 years old. This is comparable to the age reported in other studies (Peterle 1961, 1967; Bevins *et al.* 1968; Nobe and Gilbert 1970; and Garrett 1970). Only five percent of the hunters had never been married.

Seventy-one percent of the sportsmen had lived in Colorado for six years or more. Forty-five percent presently reside in population centers of 50,000 or more, 21 percent in rural areas, and the remaining 34 percent in cities and towns of less than 50,000. Eighty-four percent

of the participants had completed high school and 51 percent had at least some college.

Ninety-one percent of the sportsmen interviewed were employed full-time. Thirty percent were classified as professional-technical and 22 percent as craftsmen. The remaining 48 percent were distributed in proportion to Colorado's employed population as a whole.

In summary, the average Colorado sportsman-license purchaser had a higher educational level and income level, and was represented more in higher status occupational groups than either the average Colorado citizen (U.S. Department of Commerce 1970) or the average Colorado hunter (Nobe and Gilbert 1970).

How Do People Begin Hunting?

Sixty-one percent of our sample was introduced to hunting by their fathers; 18 percent by other males; 8 percent by brothers; 2 percent by grandfathers; and 1 percent by mothers. Only ten percent reported that no individual introduced them to hunting. Seventy-one percent of resident hunters in a Wisconsin sample reported that their fathers hunted while the respondents were growing up (Klessig and Hale 1972). These data confirm the belief that hunting interest is generated by some family males with the father playing the dominant role.

Ninety percent of the hunters indicated they had begun hunting by age 15. By age twenty-five, 98 percent of our sample had begun hunting. Studies by Klessig and Hale (1972), Bevins *et al.* (1968), and Peterle (1961, 1967) produced similar results. This indicates the critical time to teach hunter behavior and skills such as gun safety, stalking, and outdoor survival is prior to age 16.

Factors that initiated interest in hunting were love of the outdoors, influences of people, proximity to hunting areas, and interest in guns. These responses are summarized in Table 1.

Fifty-two percent of the participants spent their childhood in rural areas. This may emphasize the importance of proximity to hunting areas in initiating an interest in hunting. Studies by Hendee (1969) and Klessig and Hale (1972) found similar results.

Sixty-four percent of the participants mentioned they owned a BB

TABLE 1. FACTORS INITIATING INTEREST IN HUNTING

Factor	Times indicated	Percent of Total
Love of outdoors	347	29.3
Influence of people	258	21.8
Proximity to hunting areas	256	21.6
Interest in guns	174	14.7
Others	148	12.6
Total	1,183	100.0

gun when young. This may suggest that interest in guns or hunting may be related to owning a BB gun when young, or vice versa.

WHAT EXPERIENCES CONFIRM THEIR INTEREST IN HUNTING?

Ninety-seven percent of the hunters interviewed indicated they were confirmed hunters (*i.e.*, they planned to continue hunting). Fifty-eight percent of those interviewed felt they were confirmed hunters by age 15 and 90 percent were confirmed by age 25.

The factors that most often confirmed their interest in hunting were small-game hunting and influence of people, mostly fathers. Additional responses are shown in Table 2.

TABLE 2. FACTORS OF EXPERIENCES HUNTERS FELT CONTRIBUTED TO THEIR BECOMING CONFIRMED HUNTERS

Factors or Experiences	Times Mentioned	Percent of Total
Small Game hunting	217	30.3
Influence of people	173	24.1
Big Game hunting	97	13.5
Love of outdoors	78	10.9
Proximity to hunting areas	58	8.1
Others	94	13.1
Total	717	100.0

Memories of childhood hunting experiences were recalled easily by those interviewed. Of those who became confirmed hunters as a result of a small-game experience, 37 percent remembered the first small-game animal they harvested. Of those becoming confirmed as a result of a big-game experience, 64 percent felt the first big-game animal harvested was of major importance. These data suggest that early success in bagging game is important to continued interest.

Influence of people was also important in confirming the interest our hunters had for their sport. Albert Bandura (1962) reported that acquisition of vocational skills and social learning and attitude often occurs through imitation or role modeling. Development and confirmation of hunting interest may also be influenced by role modeling. Unfortunately, some of the modeling being done today is by irresponsible hunters. The effectiveness of law enforcement and mass media in correcting undesirable hunting behavior may be improved through hunting training courses encouraging participation by fathers and sons.

WHAT EXPERIENCES ARE MOST AND LEAST SATISFYING?

Successful big-game hunting was the most satisfying hunting adventure for most sportsmen. Satisfaction was enhanced if a trophy animal or spectacular shot was involved.

Most unfavorable experiences were related to accidents with weapons or problems with other sportsmen such as drinking or poor sportsmanship. The hunters emphasized that they were pleased to have gone on the hunting trips even though they had experienced some unfavorable incidents.

WHAT REASONS DO HUNTERS EXPRESS FOR HUNTING?

Fifty percent of the hunters interviewed indicated they had hunted at least 25 years and ninety percent had hunted for at least 10 years.

The major reason expressed for hunting was love of outdoors. Davis (1967), Klessig and Hale (1972) and Blummer (1971) also reported that enjoying the outdoors or nature was the major reason why most people hunt.

Other important reasons expressed for hunting were companionship, challenge with the animal, and need for an outdoor recreational activity. A further listing of reasons is shown in Table 3.

TABLE 3. REASONS WHY PEOPLE HUNT

Reason	Times Indicated	Percent of Total
Love of outdoors	313	15.8
Companionship with fellow sportsmen	255	12.8
Challenge with the animal	211	10.6
Outdoor recreational activity	201	10.1
Escape from daily routine	157	7.9
Food	140	7.1
Challenge with environment	127	6.4
Seeking new hunting experiences each year	124	6.2
Companionship with son or another child	113	5.7
Exercise	88	4.4
Thrill of shooting an animal	69	3.5
Other	188	9.5
Total	1,986	100.0

Reasons for hunting were significantly related ($P < 0.05$) to other demographic characteristics. Hunters under 30 years of age or with incomes of less than $5,000 were more likely to list food as a reason for hunting. This supports the popular belief that hunting is a source of food for low-income groups.

Hunters between ages 40-49 were more likely to list companionship with their son or another child. This is the age of most men when their sons begin hunting.

Hunters with some college background were more likely to list challenge with environment. Hendee (1969) found that education caused people to look more at appreciative aspects of outdoor recreation.

Hunters over 60 years of age were less likely to list escape as a reason for hunting. This is the age when many men change life styles from employment to retirement.

MANAGEMENT IMPLICATION AND CONCLUSIONS

In Colorado the average sportsman's-license purchaser started hunting by age 15. This supports the current practice in some states of requiring safety training for youth and indicates the value of public schools, scouts, 4-H clubs, and Big Brother programs as training institutions. To reach its maximum benefit, Bandura's research suggests that hunter safety training should be done where significant role models can be used rather than formal classroom-type situations.

Interest in hunting was influenced greatly by the male segment of the population. This substantiates the hypothesis that persistent behavioral patterns are passed from father to son. Although fathers may provide a valuable function in introducing youngsters to hunting, it is possible that the type of behavior they encourage may be far from perfect. The personal and social value of father-son hunting experiences is not questioned, but perhaps agencies should promote formal hunter training which includes fathers or other role models and sons. Information and education programs should continue to stress the responsibility of fathers to teach their sons proper hunting behavior.

Certain characteristics evident in the sample were their desire for success and the need for a challenge in harvesting an animal. These characteristics resemble the achievement-oriented person—a person generally attracted to challenging activities which require a successful exercise of skill (Atkinson and Feather 1966).Present agency programs have been attractive to this type of individual. More of this type of individual can be recruited by promotional efforts which stress the idea that hunting is a challenging activity requiring a great amount of skill.

The most satisfying hunting experience of most respondents was successful big-game hunting. It is a commonly accepted fact that most hunters hope to be successful in harvesting an animal, but programs which promote hunting might stress other aspects. These might include the association with the outdoors, opportunity to get away from urban setting, or the companionship with fellow sportsmen. Such programs will help maximize the recreational benefits of hunting.

LITERATURE CITED

Atkinson, John W. and Norman T. Feather.
1966. A theory of achievement motivation. John Wiley & Sons, Inc., New York, London, Sydney, 392 p. Illus.
Bandura, Albert.
1962. Social learning through imitation. In Marshall R. Jones (ed.) Nebraska Symposium on Motivation, 1962, Univ. of Nebr. Press, Lincoln, Nebr. 330 p. illus.
Bevins, Malcolm, I., Robert S. Bond, Thomas J. Corcoran, Kenneth D. McIntosh, and

Richard J. McNeil.
1968. Characteristics of hunters and fishermen in six northeastern states, Vt. Agr. Exp. Sta. Bull. 656. Also Northeast. Reg. res. publ. 76 p. illus.
Blummer, Joseph T.
1971. Life style characteristics of the hunter. American Association for Conservation Information. Albuquerque, N.M., 10 p.
Davis, William C.
1967. Values of hunting and fishing in Arizona in 1965. Coll. Bus. & Public Admin., Univ. Ariz. 91 p. illus.
Garrett, James R.
1970. Characteristics of Nevada hunters. Agr. Exp. Sta. Bull. B.22. Univ. Nev., Reno. 66 p. illus.
Gordon, Raymond L.
1969. Interviewing strategy, techniques and tactics. The Dorsey Press, Homewood, Ill. 388 p. illus.
Hendee, John C.
1969. Appreciative versus consumptive uses of wildlife refuges: Studies of who gets what and trends in use. Trans. 34th N. Amer. Wildlife & Natur. Resour. Conf. 34:252-264.
Hendee, John C. and Dale R. Potter.
1971. Human behavior and wildlife management: needed research. Trans. 36th N. 36th N. Amer. Wildlife Conf. 36:383-396.
Klessig, Lowell L. and James B. Hale
1972. A profile of Wisconsin hunters. Depart. of Natur. Resour. Bull. 60. Madison, Wisc. 24 p. illus.
Nobe, Kenneth C. and Alphonse H. Gilbert.
1970. A survey of sportsman expenditure for hunting and fishing in Colorado, 1968. Colo. Div. Game, Fish & Parks, Tech. Pub. No. GFP-R-T24. 83 p. illus.
Peterle, Tony J.
1961. The hunter-who is he? Twenty-sixth N. Amer. Wildl. & Natur. Resource Conf. Trans. 26:254-266.
Peterle, Tony J.
1967. Characteristics of some Ohio hunters. J. Wildlife Manage. 31(2):375-389 illus.
U. S. Dept. Commerce.
1970. General social and economic characteristics, Bureau of Census Pub. (1)-C7, 339 p.

SOME EFFECTS OF URBANIZATION ON BIG AND SMALL GAME MANAGEMENT

JAMES J. KENNEDY
Forest Science Department, Utah State University, Logan, Utah

As the nation's population continues to grow and urbanize, game managers can expect changes in the resources they manage and the clientele they serve. Some of these clientele changes can be categorized as: (1) changing per capita participation and fluctuating hunting license sales, (2) shifting preference for certain game species, and (3) changing attitudes and values of urban hunters.

This paper examines possible urbanization effects and their influence on amount and type of people who buy hunting licenses plus their changing attitudes. Due to data available, I do not intend to state any conclusions. My objective is to present data that suggest hypotheses for future testing. These speculations concern big and small game only; waterfowl hunting is not considered.

URBANIZATION AND HUNTING LICENSE SALES

Hunting is one of the few outdoor recreational activities that has not exhibited strong growth trends during the last decade. In 1960 the

Outdoor Recreation Resources Review Commission (O.R.R.R.C.) survey documented hunting as eleventh in per capita popularity, with 12 percent of the nation participating. A 1965 update by the Bureau of Outdoor Recreation (B.O.R.) indicated hunting had slipped to thirteenth in per capita participation. The report did not comment on the statistical significance of this change. Yet hunting was the *only* one of 22 outdoor recreational activities to decline in per capita participation between 1960 and 1965 (a decline of 1 percent). All other recreational activities increased in this period from a low of +8 percent with nature walks to a high of +92 percent for bicycling[1] (B.O.R., 1967: 22-24). Between 1965-70 the nation's 12-year and older population increased by 9.4 percent; the number of "substantial" hunters[2] increased by 753,000 (5.5 percent). The Bureau of Sports Fisheries and Wildlife (B.S.F.W. 1972:93) did not comment on the statistical significance of this increase; their data do not indicate any strong positive or negative trends.

Several states, however, have experienced strong negative trends in license sales. This appears to be a regional phenomenon concentrated in urbanizing states with a high proportion of small game hunters. Between 1957-1961, Kentucky's license sales dropped from 290,107 to 223,020 (−23 percent)—an annual revenue loss of about $200,000 in 1961 as compared to 1957. This decline was concentrated in small game license sales. The minor portion of Kentucky's license sales accounted for by deer licenses (5% of hunting license sales) has been increasing (Durell 1962). Peterle (1967) reported a decline in Ohio license sales from a peak of 736,000 (1949) to 580,000 (1964)—a drop of 21 percent. He found the number of licenses sold per county in Ohio was directly related to number of people per county ($r = +.86$) and indirectly related to population density ($r = -.59$). This negative association between per capita hunting participation and population density was also noted with Nevada deer hunters (Garrett 1970) and for both small and big game hunters of Michigan (Michigan Department of Conservation 1966).

Rural or urban residence affects many of the socio-economic variables of age, occupation, education, and income that appear correlated with hunting participation (O.R.R.R.C. 1962; B.O.R. 1967; B.S.F.W. 1966; Bevins *et al.* 1968). Rural residence also affects: growing

[1] The B.O.R. (1967) classified a participant as anyone 12 years or older spending any part of three days or 5 dollars or more on a particular recreational activity. All participation data cited in this paper concern populations 12 years of age or older.

[2] B.S.F.W. (1972:104) classifies "substantial" participants as ". . . that part of the population 12 years old and over who participated on any part of three different days or more, or spent $7.50 or more to go fishing or hunting during 1970." They estimated that substantial participants accounted for about 95% of the total recreation days and approximately 99% of the expenditures on fishing and/or hunting (B.S.F.W. 1972:103).

(1) probability of being introduced to hunting at an early age and growing up in a hunting subculture, plus (2) easy access to hunting areas as an adult, and, especially, as a youth. In 1970 there was a 3.7 percent hunting participation rate in big cities, 6.4 percent in small cities or suburbs and 13.3 percent in towns and rural areas (B.S.F.W. 1972:54). Regions of the nation also have different hunting participation rates closely associated with their population densities: ranging from a low 6 percent rate in urban Middle Atlantic States to a high of 17 percent in the Rocky Mountain States (B.S.F.W. 1972:54). This trend often continues within states. In Michigan, for example, 37 percent of Montmorency County's population (a rural county located in the upper peninsula) bought hunting licenses in 1964. That year Wayne (an urban Detroit county) had a 5 percent per capita license sale rate (Michigan Department of Conservation 1966).

Realize that per capita participation rates do not illustrate how avid a hunter a license buyer might be. I have found little data that compare rural and urban hunters on number of days spent afield. In Michigan, however, small game hunters from the rural upper peninsula hunted an average of 17.2 days in 1964. This was a 16 percent increase in average days hunted over their 1957 rate. Conversely, small game hunters from urban southern counties spent only 9.6 days afield in 1964. This was a drop of 10 percent in their average days hunted between 1957-1964 (Michigan Department of Conservation 1966).

CHANGING URBAN HUNTER ATTITUDES AND PREFERENCES

Few aspects of hunter's attitudes and preferences toward their sport have been documented; data are even more scarce on urban hunters as a sub-group. Some data suggest that hunters are different from the average American male in certain attitudes and personality characteristics (Plummer 1971). Occasionally one encounters data that indicate rural versus urban hunter differences on such things as attitudes toward doe harvesting and other policies of a state wildlife department (Moncrief 1970).

Both big game and small game per capita participation appear negatively related to urbanization, but some species might be less affected than others. Intuitively one could speculate that traditional rural activities such as 'possum and 'coon hunting have the greatest negative correlation with urban residence. Small game also appears more negatively affected by an urban residence than big game (B.S.F.W. 1972:59). Certain types of hunting such as grouse, quail, or geese might still maintain their attractiveness and prestige in an

urban environment. Cushwa and McGinnes (1964), for instance, found that 21 percent of the grouse hunters they sampled had completed four years of college education; only 4 percent of other game hunters had done so. Further research might find similar association between urban residence and species preference.

Nationally, small game hunting is more popular than big game. In 1965 and 1970 about 9 percent of Americans hunted small game while 7 percent hunted big game. These per capita rates of participation did not change between 1965 and 1970. The total number of days hunted in the nation did change for that period, however, with a —3.5 percent and +24 percent change for small game and big game respectively (B.S.F.W. 1972:93). The state of Michigan has experienced a dramatic shift in preference from small game to deer hunting. In 1940 Michigan's small game license sales were twice the number of that for deer. Since 1940 deer hunting has increased in per capita popularity while small game has declined. By 1963 per capita license sales for deer were equal to small game (Ryel *et al.* 1970).

I became involved in research with urban deer hunters quite by accident. Several of us at Virginia Polytechnic Institute were involved with Maryland's Department of Game and Inland Fish in a cooperative project to more systematically manage joint-outputs of deer and timber from state lands. The Pocomoke State Forest, Maryland was one area selected for study. The State Forest is a flat Atlantic coastal pine site of 13,000 acres with a dense brush understory. It is located about 120 miles east of Baltimore and receives heavy deer hunting pressure from that metropolitan area. After touring the forest to examine deer hunting problems, several wildlife managers as well as we enlightened academicians *assumed* that the Pocomoke was producing a low quality deer hunting experience and that we should do something about it. After all, there was "excessive crowding" in the woods and campground plus hunter success was low. Certainly every hunter must have almost feared for his life as we sometimes did. Also with proper management, we might increase the probability of hunters getting that nice trophy buck we thought they all wanted. After these lofty, autocratic pronouncements, we had an unprofessional fit of humility and decided to test our value judgments about Pocomoke deer hunters.

A mailed questionnaire generated 373 returns (an 82 percent response) and represented about 20 percent of the deer hunters using the Pocomoke State Forest during the 1969 deer season (Kennedy 1970). Approximately 75 percent of the hunters were from the Baltimore metropolitan area. None was black.

During 1969 the Pocomoke had a buck only season and experienced

a very low success rate of 3 bucks per 100 hunters. We were surprised to find that the majority of our respondents (62 percent) said they still had an excellent or good time on the Pocomoke in 1969; 24 percent had a fair time and only 14 percent checked a poor or very poor time. We then asked the things they enjoy most about deer hunting. These "things" were classified as hunt rewards (things associated with seeking and killing the deer) and extra-hunt rewards (things not directly related to actually hunting as companionship, getting out of doors, etc.). The suspense and challenge of the hunt was ranked as either #1 or #2 in importance by 63 percent of the sample. Next in total number of rank #1 or #2 responses was getting-out-of-doors, followed by companionship rewards and getting-away-from-it all. The reward of actually killing the deer was fifth in total rank #1 or #2 responses received. Further examination showed that 57 percent of the respondents had never killed a deer before, and 78 percent would only be "slightly" or "not disappointed at all" with not killing a deer next season. Most would be satisfied by killing any deer (buck or doe).

Notice that companionship of one's hunting associates was rated as an important reward. In fact, only 7 percent of the respondents hunted the Pocomoke alone. We asked those hunting with a buddy or group how social rewards of the group compared to actually hunting the deer, and 83 percent said the companionship of their buddy or group was of similar or greater enjoyment to actually hunting the deer.

Another important area of questioning concerned respondents' reaction to *all* those other hunters, for we estimated there to be over 15 hunters per 100 acres on the Pocomoke for opening day. Respondents said they usually saw 7.4 other hunters (mean) in the woods while hunting. When asked if they were ever bothered by these hunters, 67 percent checked seldom or never bothered, 22 percent sometimes bothered, and 11 percent very often bothered. The majority (89 percent) perceived their fellow Pocomoke hunters as similar in "care and courtesy" to the average hunter. Also, when questioned if there were enough other hunters "to move the deer" on the Pocomoke in 1969, the majority (53 percent) said *not* enough other hunters.

Responses to these and other questions challenge the value judgments we previously made about Pocomoke deer hunters plus our assumptions about their reaction to and evaluation of their hunting experience. I suspect we were a poor reference group to be making value judgments on the perception, reaction, and evaluation of Pocomoke deer hunters. For most of us were sophisticated woodsmen and purist hunters with strong orientation toward killing a nice buck,

a low tolerance for crowding, a pessimistic perception of the care and courtesy of other hunters, and many more biases I am sure.

IMPLICATIONS

State wildlife agencies are not in business to make money, but all desire to survive as a viable organization. Some state agencies are finding this increasingly difficult in face of lagging hunting license sales, steady cost inflation, and political resistance to license increases. The state of Utah has experienced stable annual hunting license sales through the 1960's. The push of increased responsibilities and inflating costs, however, has caused the Utah Division of Wildlife Resources to ask for general fund money this fiscal year for the first time in its history. In the past, the Division refrained from involving general state money in their affairs due to apprehension of increased political control over their organization. The hard facts of finance have compromised these political apprehensions.

Hunting license sale trends throughout the nation do not lend themselves to sweeping generalities. Traditional small game hunting states like Ohio, Indiana, and Illinois have experienced steady hunting license declines during the 1960's. Michigan's rise in deer hunting participation has managed to offset its declining small game popularity and maintain a relatively stable license sale trend. New York and Pennsylvania, lagging in license sales in the early 1960's, have experienced a rising trend after mid-decade (B.O.R. 1971:107). With the nation's population stabilizing and per capita hunting participation failing to increase, I cannot be bullish on the hunting license market. Bevins *et al.* (1968:34) found in such urban states as New York and Massachusetts that 64 percent and 67 percent of their hunters, respectively, spent "most of their childhood in rural areas." The long-run effects on hunting participation rates, species preference, hunting attitudes, and anti-hunting sentiment as we become a nation of second and third generation urbanites is anyone's guess. But some good guessing had better begin for such changes might be more important in the future than many of the habitat, disease, and behavioral aspects of wildlife management currently being emphasized in research.

With the Pocomoke deer hunter we examined an isolated example of discrepancies between what wildlife managers think their clients want and what their clients say they want. I suspect wildlife managers have always been delinquent in appreciating what I call the extra-hunt rewards of hunting such as getting-away-from-it-all, companionship, and other social rewards. This is not a serious oversight if one's clients are completely involved in the hunt rewards of seeking and

killing a deer. But I doubt if many deer hunting experiences fit this Daniel Boone stereotype. I would speculate that as hunters become more urban the extra-hunt rewards of all types of hunting will increase in importance.

This does not mean that we manage the Pocomoke Forest as a summer camp with wildlife managers acting as social directors. But I suspect that given $150,000 to improve deer hunting on the Pocomoke, most wildlife managers would react by investing in alternatives to increase deer populations. Why not; more deer equal better hunting, right? Let me suggest that we also consider investment in a decent hunter map of the forest, that forest roads be named and well signed, that trails be laid out and marked to disperse hunting pressure, that wildlife food plots not be strung along forest roads but placed back in dense brush to create more shooting breaks and encourage hunter dispersion, and other alternatives to help the present deer population and hunters interact more often. One might also consider investments that would increase the pleasure of extra-hunt rewards such as scattered group-hunting campsites.

I would also like to criticize the heroic assumption that led us to examine the Pocomoke deer hunter in the first place. Namely, he was different from the "traditional, rural hunter" that we all know and love. Who is this traditional hunter stereotype? What are his norms and how does he act in his native habitat? I have never seen the species scientifically described, although I have been privy to numerous fireside chats among scientists who bemoan the loss of this noble creature and criticize assumed norms of "those city hunters." These discussions are fun, but hardly scientific. There would be a healthy release for us over-worked wildland managers if such folklore did not have influence on our decisions. Take the perception and value judgments we made about hunter crowding on the Pocomoke, as an example. Actually, there are three views of crowding on the Pocomoke to be considered: (1) views of forest managers, (2) views of local county residents, and (3) views of those who hunted the forest. Both managers and local residents saw the forest as too crowded and full of "crazy city hunters," and would not hunt there. Only eight questionnaire respondents (2 percent) lived within a 25 mile radius of the state forest. Yet of the remaining 365 respondents who hunted the Pocomoke, only a minority felt that their fellow hunters were unsafe, discourteous, or too numerous.

I don't know if the Pocomoke hunter is different from the "average" Maryland deer hunter, or the rural Appalachian deer hunters, or different from those of us who make decisions that affect his welfare. We have inadequate data on all these groups. Perhaps it's

time we became concerned enough about our present and potential clients in wildlife management to begin eliminating such ignorance.

LITERATURE CITED

Bevins, M. I., R. S. Bond, T. J. Corcoran, K. D. McIntosh and R. J. McNeil.
1968. Characteristics of hunters and fishermen in six northeastern states. (Bul. 656). Burlington: Vt. Agr. Exp. Sta.

Bureau of Outdoor Recreation (B.O.R.)
1967. Outdoor recreation trends. Washington, D.C.: U.S. Govt. Printing Office.

———.
1971. Selected outdoor recreation statistics. Washington, D.C.: U.S. Govt. Printing Office.

Bureau of Sport Fisheries and Wildlife (B.S.F.W.)
1972. 1970 national survey of fishing and hunting. Washington, D.C.: U.S. Govt. Printing Office.

Cushwa, C. T. and B. S. McGinnes.
1964. "Recreational use of the North River area, George Washington National Forest." Virginia Wildlife. 25(11):16-17.

Durell, J. S.
1962. "A study of Kentucky hunters who hunted only in their home counties." 16th An. Proc.: Conf. of S.E. Game and Fish Comm. pp. 171-174.

Garrett, J. R.
1970. Characteristics of Nevada hunters. (B-22). Reno: Nevada Agr. Exp. Sta.

Kennedy, J. J.
1970. "A consumer analysis approach to recreational decisions: deer hunters as a case study." Unpub. Ph. D. dissertation. Virginia Polytechnic Institute and State Univ. (Univ. microfilm #71-13-163).

Michigan Department of Conservation.
1966. Michigan outdoor recreation demand (Vol. II). Ann Arbor: Mich. Dept. of Conservation.

Moncrief, L. W.
1970. An analysis of hunter attitudes toward the state of Michigan's antlerless deer hunting policy. Unpub. Ph. D. dissertation. Michigan State Univ. (Univ. microfilm #70-20-501).

Outdoor Recreation Resources Review Commission (O.R.R.R.C.)
1962. Participation in outdoor recreation: factors affecting demand among American adults (Study Rpt. 20) Washington, D.C.: U.S. Govt. Printing Office.

Peterle, T. J.
1967. "Characteristics of some Ohio hunters." Jour. of Wildlife Mgmt. 31(2):375-389.

Plummer, J. T.
1971. Life style characteristics of hunters. Paper at Am. Assoc. of Conservation Information. Albuquerque, N.M. (Feb. 22).

Ryel, L. A., G. C. Jamsen and L. J. Hawn,
1970. Some facts about Michigan hunters. (Report 197). Ann Arbor: Mich. Dept. of Natural Resources.

THE ETHICS OF HUNTING AND THE ANTIHUNTING MOVEMENT

DAVID R. KLEIN
Alaska Cooperative Wildlife Research Unit, University of Alaska, Fairbanks

Antihunting sentiment in North America, as well as in Europe, continues to proliferate at an alarming rate and has become a political force threatening the future of hunting as a sport. The antihunting "passion" appears to have at least some of its roots in the symbolism associating the gun with crime and violence. In the eyes of the public, the gun has increasingly come to represent the tool of criminal violence and the weapon of seemingly pointless wars which degrade humanity; it is seen as the direct agent of death and destruction. When large elements of society are turning against expressions of overt aggression, the gun, whether in the hands of the criminal, the soldier, or the hunter, symbolizes aggression; therefore, the hunter, by association, becomes a primary focus for anti-aggression appeals.

The traditional justifications given in defense of hunting have failed to provide the basis for understanding of the sport which is essential for its acceptance by the nonhunting public. Typical statements in defense of hunting, in fact, tend to accept the tacit assumption that hunting may be morally wrong. In a booklet sponsored by an ammunition company and prepared by game biologists with the purpose of providing the aspiring hunter with a moral basis to justify his hunting activities (Madson and Kozicky 1963:32), the authors attempt to answer the questions, "Why do you kill wild game?," or, "Why do we hunt?" Their reply is, "We do not hunt if shooting endangers the game supply. But if there is enough game to support hunting, it is no less merciful to shoot the game than to leave it to die naturally by fang, storm, starvation and sickness." Hunting is presented here as the lesser of several evils, and ethical standards are projected into nature.

Until the recent focus of attention on ecology, it was also common to see statements such as the following which appeared in an advertisement for ammunition in national sporting magazines in the early 1960's: "Use . . . high velocity .22 long rifle ammunition to eliminate hawks, foxes and other varmints in your area. Do your share to help wildlife." In addition to the ecological ignorance expressed in the statement, this admonition fosters the concepts that there are both good and bad animals and that man, the hunter, can intervene in protecting the good from the bad. He can also justify his hunting of the good ones by saying that it is in their own interest, that is, the interest of the species or the population. These views of nature are

common ones among the general public, whether they are associated with strong views about hunting or not. These appear to result from the projection of Christian morality into nature: that the "weak" and the "defenseless" ones are the herbivores—the innocent ones—while the carnivores, those animals that must kill to live, are the "evil" or "sinful" ones. Man's tendency to anthropomorphize or humanize other animals is also involved. This is characterized in our folklore by creatures such as the big bad wolf, the sly fox, the gentle lamb, and more recently Mickey Mouse, Bambi Deer and Smokey Bear.

Another justification often given for hunting which is of a more philosophical nature can be paraphrased as follows: "Man in hunting is merely exhibiting his close historical association with the land. He evolved as a hunter. The thrill of the chase is a legacy from the past. For civilized man to continue to yield to this primitive urge is neither ethically nor morally wrong, but is the way of nature. Hunting is essential for the psychological well-being of those individuals who feel this close relationship between man and his biological and cultural past." This argument tends to avoid critical analysis because it is extremely difficult to establish the relationship of modern man's behavior to that of his evolutionary past. Several attempts to do this, however, have been made recently. Robert Ardrey's (1961) *African Genesis,* is perhaps the first attempt aimed at the public, but more recently, Konrad Lorenz (1966), Desmond Morris (1968) and several other authors have attempted to relate the behavior of modern man to his evolutionary past. These have been controversial works, and they have by no means resolved the question. There is, however, little question of man's hunting ancestry. Washburn and Lancaster (1968:303) point out that man has been a hunter for 99 percent of his history and emphasize that,

> The biology, psychology, and customs that separate us from the apes—all these we owe to the hunter of time past. And, although the record is incomplete and speculation looms larger than fact, for those who would understand the origin and nature of human behavior there is no choice but to try to understand "Man the Hunter."

Hunting, according to Leopold (1949), represents man's effort to re-create an aspect of his more primitive past when he was bound more closely to nature than he is at present. He placed emphasis, however, on man's cultural history rather than his evolutionary origin. Leopold stressed the importance of restricting the application of man's modern technological advantages to the hunt if this value of hunting was to be preserved. Similarly Ortega y Gasset (1972:53)

observed: ". . . as the weapon became more and more effective, man imposed more and more limitations on himself as the animal's rival . . . as if passing beyond a certain limit in that relationship might annihilate the essential character of the hunt, transforming it into pure killing and destruction." The deteriorating image of hunting in the public eye seems at least partly associated with the apparent contradictions of sportsmanship in the increasing use in hunting of aircraft, all-terrain vehicles and other highly sophisticated products of technology.

While a case can be made for the relationship of our hunting to our cultural traditions, it is certainly debatable whether it is *essential* to man's well-being that he hunt, or that he *must* find outlets for his hunting motivations by actually hunting. While the "hunting ancestry" argument attempts to explain man's psychological motivation for hunting, it avoids the basic issues of ethics and morality as they relate to hunting. It is like saying that if man has been a killer in his evolutionary past, then it is natural for him to kill, and therefore justifiable. This is not good logic, however, because modern man is no longer living in a "natural" way, and there is ample precedent for the need as well as the ability, of man to control certain aspects of his biologically motivated behavior in the broader interests of society.

THE ANTIHUNTING POSITION

The popularization of ecology and the associated environmental concern which have developed in this decade have also been accompanied by emotional and quasireligious attitudes toward nature. These attitudes, although stimulated by the recent emphasis on ecology, often focus on individual animals rather than populations and ecosystems and provide the basis for much of the current antihunting sentiment. Pantheism and a new "vitalism" characterize many of the recently emerging nature-oriented movements associated with the counter cultures common to the current social change.

Pierre Teilhard de Chardin's (1955) concept of a universal consciousness and his pantheistic theology, expressed in his *The Phenomenon of Man,* although largely rejected by Christianity because they undermined Christian monotheism, nevertheless broke the literary ground for such modern day writers as Alan Watts, Eric Fromm, and others who have become outspoken advocates of the new "ecoreligion" which is founded on the concept of "oneness of life," or "universality of matter" as an extension of Eastern philosophical-religious thought. In effect, nature is deified as an all-encompassing unifying concept, and man, recognizing his biological origins and his dependence on and relationship to all living systems, achieves humility

through perspective of his place in nature. Nature takes on maternal significance, being the source of all life, of all productivity, and of man, and thus man can assume a filial affection toward the totality of nature and a kinship toward other organisms. Such views of nature usually emphasize the uniqueness of life, and the implicit assumption is made that a rationality exists in nature, that nature is purposeful with inherent goals and morality. Often the most outstanding among the promulgators of ecological knowledge give expression to this concept, at least metaphorically, through such statements as, "Life exists in its own right and this we must acknowledge" (Darling 1968:119), or, ". . . all created things have their rights and . . . the right to live is one of theirs" (Krutch 1957:40).

Many antihunters claim support from Albert Schweitzer (1964), particularly from his concept of "reverence for life." Schweitzer's renown as a theologian, humanitarian and philosopher have made his "reverence for life" ethic virtually an authoritarian one. It seems to be unchallengeable by the common man because of the human tendency to believe—or at least to want to believe—that a man like Schweitzer was right in a particular area of thought when his philosophical pronouncements in so many other areas have been associated with "correct" morality, high ethical standards and human compassion.

Schweitzer's "reverence for life" ethic holds that life is a unique entity beyond human comprehension and is the gift of God. Man should, therefore, respect life in all living organisms, and he should avoid causing suffering and death if at all possible. Schweitzer's philosophy is one of vitalism. He states (1964:317): "The ethics of reverence for life know nothing of a relative ethic. . . . All destruction of and injury to life, under whatever circumstances they take place, they condemn as evil." It is an absolute ethic with no qualifications and no exemptions. In spite of his strong commitment to the ethic, he made rather arbitrary qualitative distinctions and exceptions in practice. He kept a gun in Africa and used it to shoot snakes and predatory mammals and birds; and he justified this killing as protection for the domestic animals that were kept within the compound (Schweitzer 1951). He also frequently refers in his writings to the struggle to subdue and destroy the ever-encroaching tropical vegetation. Ironically, many of his efforts in Africa were devoted toward destroying life: the predators, the encroaching vegetation and the disease organisms among the native people.

If Schweitzer is to be interpreted literally—and he himself stressed that this is what should be done—then we must assume that he conceived of all living things as wards of mankind. This would

include predators, plants and disease organisms as well. The extreme projection of Schweitzer's ethic to include plants and disease organisms may appear to be deliberately clouding the issue, but it is necessary to emphasize the contradictions inherent in Schweitzer's position. Shepard (1967), who has made an eloquent analysis of Schweitzer's "reverence for life" concept in relation to hunting, pointed out that Schweitzer did not arrive at this concept as one who loves nature, but rather he looked upon nature as the ". . . cruel drama of the will-to-live divided against itself . . ." (Schweitzer's quote from Shepard). Man, as God's agent, could intervene to limit the cruelty of nature. Ironically this is the same ethical justification discussed above in support of hunting.

A viewpoint common to those opposed to hunting is expressed in the following statements by Krutch (1957:9), "Any activity which includes killing as a pleasurable end in itself is damnable." Krutch sees the hunter as one who "does evil for evil's sake." This viewpoint expresses a lack of understanding of hunting as a complex sequence of activities among which killing is only one of many components. It is like asking, How can the farmer find enjoyment in raising animals to be slaughtered? It should be obvious that killing or causing of pain are neither the objects of animal husbandry nor of hunting, but they are incidental although indispensible parts of both activities of man.

The hunter's veneration of the prey toward which the violence of the hunt is directed is difficult for the nonhunter to appreciate. Its explanation apparently lies deep in our evolutionary past when, according to Giedion (1961), "Animals were simultaneously objects of adoration, life-giving food and hunted quarry. This two-fold significance of the animal as object of worship and source of nourishment is an outcome of a mentality which did not confine the sacred to the thereafter. For them the sacred and the profane were inseparable." Giedion sees modern man's attitude toward nature as anthropomorphic in contrast to a zoomorphic attitude of primitive man. Antihunters may have lost sight of this distinction when they argue that man has evolved, at least culturally, beyond his savage ancestral ways. The modern man who hunts is, in their view, exhibiting an atavistic urge and has not matured psychologically, socially or culturally. This argument does not make a case against hunting, but rather challenges its supposed therapeutic values.

Along a similar vein, those who hunt are often accused of doing so because of the conscious or subconscious feeling of masculinity which they derive from the sport. Gilbert (1967:16), in a tirade against hunters in an article in the *Saturday Evening Post* stated, "Each one seems to believe that because he is trying to shoot an inoffensive

animal, he is a tough, crafty, courageous woodsman whose chest is covered with hair, a figure out of James Fenimore Cooper by Ernest Hemingway." Most men who hunt would acknowlege that an enhanced feeling of manliness derives from the hunt, albeit incidental to other aspects of hunting. However, should such men be labelled as sexually insecure and the gun portrayed as a phallic symbol to them? If so, then it would seem that the sexual consciousness that is so much part of our daily lives is also to be condemned. As in the example of the previous argument, this one also fails to make a case against hunting; instead it relates hunting to man's psychological health rather than challenging it on the basis of ethical or moral grounds.

MAN'S EXPLOITATION OF ANIMALS

The question of the justification for hunting is only part of a much larger question—that of the morality of man's exploitation of other organisms. By exploitation I mean any manipulation of other organisms by man which results in altering their ways of life, or in imposing upon them hardship, injury or death. For the practical purposes of this discussion, in addition to hunting, this would include domestication, experimentation with animals, and destruction of wildlife habitat; however, the list could be extended to include the impact of man on all forms of life without greatly altering the logic involved in its justification.

Man has traditionally attempted to justify his exploitation of other animals on the basis of the value of such action to mankind. Such justification has been of utilitarian or pragmatic nature with very little reference to, or consideration of, ethics or morality. Man has argued that his use of other animals is essential for human well-being and survival, that he is dependent upon them for food, clothing and as beasts of burden. Man as an individual, however, is not dependent upon animal protein to live a healthy life, although there is a common misconception to this effect in the Western world. The sacred cow may pose ecological problems in the East, but it is symbolic of a religious heritage that is quite foreign to our meat-eating habits. Nor are animal skins and fibers or animal traction *essential* for human survival. If we are to be idealistic, it is very difficult to justify man's use of other animals on the basis of his dependence on them.

When we destroy the habitat of wild animals, we are in effect exploiting these animals and are using them poorly by generating negative influences on their lives. We do this in the name of improvement of man's well-being, to create areas for homes, highways or industry or for other uses. We display animals in zoos to satisfy the curiosity of the public, which we categorize as education. We

exploit pets by subjecting them to regimentation in their lives, which often leads to neuroses (Fox 1972), primarily for the recreation and satisfaction that this close relationship provides us. It is true that we shower affection on our pets and that they often return some of this affection; however, we do this for our own satisfaction, and the animals involved are not free to choose this relationship.

In comparing hunting to other uses of animals, the question of ethics or morality is one of degree in relationship to the relative impact on man. For example, if we can justify exploiting animals for food, then hunting should also be justifiable; and conversely if any exploitation of animals is considered morally wrong from the standpoint of the interest of the animals themselves, then all exploitation should fall in the same category.

The most controversial category in man's use of animals is that of the blood sports, which includes hunting, bullfighting, falconry, and any of those sports resulting in either injury or death to the animals involved. Opponents as well as advocates of these activities acknowledge that they provide recreation and satisfaction directly to man. In principle, in regard to the value to mankind, hunting is essentially the same as other ways of using animals. The various uses man makes of animals may or may not result in the injury or death of individual animals. However, all uses at least alter the way of life of the animals involved. Although we do not usually consider all types of exploitation of animals on an ethical or moral basis, the principle involved is similar in each case. Hunting, although controversial, certainly has utilitarian value; it serves the interests of man just as does animal husbandry, keeping a pet or poisoning rats in the city dump. The redeeming social value of hunting has been very eloquently stated by Ortega y Gasset (1972); and Leopold (1949), Clarke (1958), and Shepard (1967) have also been outstanding literary advocates of the sport.

Any ethical distinctions that exist in the justification of hunting versus the justification of any other uses of animals, if a defensible logical analysis is to be made, must relate to the relative values of these activities to man, or in conflicting values between various uses, and *not* to differences in the effects on the animals involved. The latter consideration is one for their biological management.

We can, however, logically argue against hunting in special cases where hunting is in conflict with other "uses" of wildlife which may provide greater returns to society. It may also be necessary to honor cultural traditions and beliefs out of respect for the groups that hold them. An example from Alaska occurs among the Indians in the southern coastal regions, who traditionally have looked upon ravens

as the reincarnation of their ancestors and honor them in their art and clan structure. They are understandably offended if ravens are deliberately killed. In recognition of the beliefs of these people, the Alaska Board of Fish and Game prohibits the hunting of ravens in that area. The wildlife management agency in this case has acquiesced to cultural tradition which probably has a stronger claim than any recreational value that might result from hunting of ravens in that area. In spite of the action taken against hunting, in this example, the decision was made on the basis of conflicting interests of man and not on any question of morality with regard to the treatment of ravens.

AN ETHICAL BASIS FOR HUNTING

Guthrie (1967) has pointed out that the dilemma or logical trap that Schweitzer found himself in, as well as many others who on ehtical grounds oppose hunting and other uses of animals by man, results from our tradition of belief that the basis for our ethical values and moral standards has been some outside agency. Moral principles, however, and the standards by which they are judged are human constructs, and thus they can be evaluated on an empirical basis. The only underlying apriori assumption in this system is that man's rules of conduct should be in his own (i.e., society's) interest. Aristotle (Hardie 1968) and in more recent times, Kant (1873) have both stressed that ethics have no relevance except in governing relationships between human beings. Although Kant's views on the irrelevance of religious motivation to the development of morality have been largely superceded, his argument that modern ethics, be they of religious or nonreligious derivation, need not draw their support from transcendental sources remains a viable one acceptable to Western theologians as long as the question of motivation is excluded.

Guthrie (1967) maintains that morality and ethics, being human constructs, relate only to man and cannot be extended to other organisms. That is, moral judgments can be made of man's actions, but not of those of other animals. Therefore, all other organisms are amoral bodies. There is no place within such a system for judgments of "the bad wolves that kill the good deer" or "the bad insects that bite us or carry disease and the good ones that pollinate plants." Schweitzer, because he included all of life within the human ethical system, was forced into these categorizations. He classified predators as bad because they caused pain or killed, acts which he had already defined as evil or cruel. Obviously all those who have extended ethics to other organisms have been faced with the problem of creating moral classifications within nature. This is not to deny the relation-

ship of man to other life as was characteristic of Cartesian philosophy nor to fail to be awed by the complexity and beauty of life, but rather to recognize the boundaries of our ethical system. Man's actions toward other entities, be they living organisms or inanimate objects, should be evaluated by the relative impact of such actions on man and not by any absolute or inherent value these things are thought to possess, or of moral classification of their "goodness" or "badness." Neither should the acts themselves be judged good or bad; these judgments only gain relevance in relation to man.

Human acts, such as hunting or domestication, which are committed toward other organisms can only be evaluated realistically through their human effects. However, these effects should be interpreted in their broadest possible sense. We can argue, for example, that whereas hunting may provide immediate recreational returns, in some situations, hunting of an animal species may destroy the opportunity for its observation and enjoyment by people either now or in the future, and therefore hunting should be avoided. Similarly if hunting under certain circumstances fosters disrespect for life and nature or is otherwise degrading to man, it should not be condoned.

It follows from the preceding discussion that there are valid moral and ethical obligations as well as restraints, associated with hunting, but only those that relate our hunting conduct to ourselves and other humans—other humans living and yet unborn. Justifications for opposing the act of hunting should therefore fall within this concept. Each hunting situation should be considered on its own merits, on its total impact on man. In other words, within such a framework, we can logically question the methods and means employed and their impact on all segments of society, including the hunter, but not the act of hunting itself.

A final consideration that relates to hunting is man's attitude toward death. Man, in his concern over death in other organisms, is primarily anthropomorphizing. Man's vitalistic tendency is associated with the projection of his own value of life to other organisms, or we might say, projection of his fear of death to other organisms. Biological knowledge indicates that death is an essential component of the evolution of life, and of living systems as we know them today. Without death of individuals, there can be no continuation of the life forms that now exist.

An expected criticism of the justification for hunting through rationally-based ethics is that such a system is too coldly objective, too hard, and lacking in compassion for life. Rational ethics, however, can provide the basis for a very humane ethic toward the totality of life, an ethic which can yield to mankind a large return of both social

and aesthetic values. It provides a basis for deep and realistic understanding of life. It is a further extention of the growing recognition that an appreciation for and understanding of the complexity of nature is essential if man is to benefit from his relationship with nature rather than to be destroyed by it. Hunting provides one avenue for the development of such an understanding and appreciation of all life and its complexities and of its beauty and its relationship to man. Ortega y Gasset (1972: 141, 142, 59), with keen perception and expressive simplicity has summed up the elemental relationship of the hunter to nature:

> . . . the hunter, while he advances or waits crouching, feels tied through the earth to the animal he pursues . . . [he] perceives the environment from the point of view of the prey without abandoning his own point of view. . . . There is, then, in the hunt as a sport a supremely free renunciation by man of the supremacy of his humanity.

SUMMARY AND CONCLUSIONS

The loss of stature of the hunter in the eyes of a growing segment of the public seems tied to the increasing association of the gun with crime, war and violence, and to emotional attitudes toward nature stimulated by the current focus of attention on ecology. Hunting, as a complex relationship of man to nature and a sport with strong historical roots, is characteristically misunderstood by nonhunters. Antikilling sentiment directed toward hunting also appears to derive from the projection of Judeo-Christian morality into nature as well as from the proliferation of vitalistic attitudes about nature based on a misinterpretation of ecology.

Hunters have contributed to their own deteriorating public image by failing to emphasize and maintain the qualitative aspects of the hunt and by assuming a defensive stance with regard to the ethics of hunting. Philosophical logic stresses that morality and ethics have relevance only to human interrelationships and are inappropriate to the relationship of man to other organisms. Hunting is a human use of animals and it should be judged on essentially the same basis as are other human uses of animals. Hunting is a use of animals that yields benefits to society and is therefore justifiable to the extent that it does not conflict with other more socially valuable forms of behavior or the long-term social welfare.

It seems evident on the basis of the preceding discussion that the future of hunting as a sport remains threatened unless a change in the trend in public attitudes is forthcoming. Specific action toward achieving such a change should include research to more clearly define

the elements of psychological conflict existing between the hunter and the antihunter. Such studies will likely emphasize the differing values held by these two groups and could therefore provide the orientation for educational efforts aimed at altering those values which are based on a too superficial understanding of nature or misunderstandings of nature, on a lack of appreciation of the social criteria for ethical standards and on an unawareness of the complexities of hunting as a sport.

Finally it is up to hunters themselves and those who would be advocates of the sport to bring about a re-emphasis on quality in hunting and to return to hunting those high standards which have won it respect in the past.

ACKNOWLEDGEMENTS

The development of ideas presented in this paper was greatly enhanced through discussions with R. D. Guthrie, Dept. of Biological Sciences and R. W. Krejci, Dept. of Philosophy, University of Alaska. I also appreciate the critical review of the manuscript provided by P. C. Lent, Alaska Cooperative Wildlife Research Unit, and J. C. Hendee and colleagues, U.S. Forest Service, Seattle, Washington.

LITERATURE CITED

Ardrey, R.
1961. African Genesis; a personal investigation into the animal origins and nature of man. Atheneum, New York. 380 p.
Clarke, C. H. D.
1958. Autumn thoughts of a hunter. J. Wildl. Mgmt. 22(4):420-427.
Darling, F. F.
1968. Man's responsibility for the environment. Institute of Biology Symposium—Biology and Ethics. pp. 117-122.
Fox, M. W.
1972. Neurosis in dogs. Sat. Review—Science 55(44):58-63.
Giedion, S.
1961. Constancy, change and architecture. First Gropius Lecture. Harvard Univ., Cambridge.
Gilbert, B.
1967. Hunting is a dirty business. Sat. Eve. Post (Oct. 21), 240 (21):16-17.
Guthrie, R. D.
1967. The ethical relationship between humans and other organisms. Perspectives in Biol. and Medicine 11(1): 52-62.
Hardie, W. F. R.
1968. Aristotle's ethical theory. Oxford Clarendon Press. 370 p.
Kant, I.
1873. Critique of practical reason. Trans. by T. K. Abbott. Longmans, Green & Co., London. 368 p.
Krutch, J. W.
1957. The sportsman or the predator? I. A damnable pleasure. Sat. Review (Aug. 17): 8-9 and 39-40.
Leopold, A.
1949. A Sand County almanac. Oxford Univ. Press, New York. 226 p.
Lorenz, K. Z.
1966. On aggression. Trans. by M. K. Wilson. Harcourt, Brace and World, New York. 306 p.
Madson, J. and E. Kozicky.
1963. For the young hunter. Olin Mathieson Chemical Corp., East Alton, Ill. 52 p.
Morris, D.
1968. The Naked Ape; a zoologist's study of the human animal. McGraw-Hill, New York. 252 p.

Ortega y Gasset, J.
1972. Meditations on hunting. Charles Scribner's Sons, New York. 152 p.
Schweitzer, A.
1951. The Animal World of Albert Schweitzer. (C. R. Joy, Ed. and Trans.) Beacon Press, Boston.
———.
1964. The philosophy of civilization. Trans. by C. T. Campion. The Macmillan Co., New York. 347 p.
Shepard, P.
1967. Man in the landscape. Alfred A. Knopf, New York. 290 p.
Tielhard de Chardin, P.
1955. The Phenomenon of Man. Trans. by B. Wall. Harper & Row, New York. 320 p.
Washburn, S. L. and C. S. Lancaster.
1968. The evolution of hunting. p. 293-303 in "Man the Hunter" (Ed.) R. B. Lee and I. DeVore. Aldine Pub. Co., Chicago, 415 p.

SOME FACTORS ASSOCIATED WITH ATTITUDE TOWARD DEER HUNTING IN NEW JERSEY RESIDENTS[1]

JAMES E. APPLEGATE
Department of Horticulture and Forestry, College of Agriculture and Environmental Science, Rutgers University, New Brunswick, New Jersey

Hunting as an acceptable form of outdoor recreation appears to be under increasing public condemnation. Recent attacks on hunting and trapping in New Jersey, for instance, have taken the form of court injunctions (Great Swamp National Wildlife Refuge), State legislation (ban on leg-hold traps in most areas of the state) and local ordinances (ban on discharge of firearms in several townships and pressure for similar action in many more). Proliferation of journalistic articles for and against hunting add further credence to this supposition. Nonetheless, the extent of literature on this topic consists of attacks and rebuttals—editorial journalism without new information.[2] Systematic studies are unavailable. Initial studies of attitudes in the general population must therefore be exploratory and descriptive. The present study assesses the magnitude of anti-hunting sentiment in the State of New Jersey and describes some factors which are related to a person's attitude on deer hunting.

New Jersey is an appropriate place for such a study. A precedent for deer-people studies was established there with Paul Tillet's *Doe Day* (1963), an excellent study of the controversy over antlerless deer harvest. Much of what Tillet described of New Jersey and New Jersey's deer (and, incidentally, the controversy) remains the same. New Jersey lies in the heart of the northeastern megalopolis. The average population density is 953 people per square mile (U.S. Dept. of Commerce 1971), concentrated in a densely populated corridor

[1] A paper of the Journal Series, New Jersey Agricultural Experiment Station, Rutgers University, Forestry Section, Department of Horticulture and Forestry.
[2] A partial bibliography of recent articles has been compiled by Dale Shaw of Colorado State University, Fort Collins, Colorado. For an earlier review of literature and an excellent discussion of the topic, see Clarke (1958).

from New York City to Philadelphia. In Hudson County, for example, the population density is 13,094 people per square mile. To the north and south of this corridor, populations are less dense, but developing rapidly. Despite the pressures of humanity, New Jersey supports a substantial population of deer: State biologists estimate the average pre-hunting season population at about 50,000 animals. From this herd, 190,418 licensed firearm hunters and 30,795 archers harvested 7,545 animals in 1971 (N.J. Dept. of Env. Protection 1972). New Jersey thus represents an advanced form of the problems that will be faced thoughout the country with respect to the harvestable wildlife resource—a substantial population of hunters and a substantial population of harvestable game existing in close proximity to an urbanizing society.

METHODS

The data were collected by the Eagleton Institute for Politics at Rutgers University in their May, 1972 New Jersey Poll. The New Jersey Poll is similar to the national Harris and Gallup polls, except that it is limited to the State of New Jersey. The May, 1972 poll was focusing on the presidential primaries, with additional questions on New Jersey politics, off-track betting and abortion. Questions added to the poll as part of this study comprised less than 10 percent of the interview. Respondents were asked, "Do you approve or disapprove of deer hunting?" They were then asked if they would describe their attitude as strong or mild approval/disapproval. Responses to this series of questions thus yielded a five-point scale of attitude on deer hunting, ranging from strong approval through undecided to strong disapproval.

The second question pertained to the respondent's association with hunting. They were asked, "Have you ever hunted?" Affirmative respondents were asked, "Have you gone hunting at all in the past two years?" and negative respondents were asked, "Has anyone in your family or any of your close friends gone hunting in the past two years?" Respondents could then be rated on a four-point scale relative to their association with hunting, ranging from the person who is actively involved in hunting to the person who has never hunted and has no close association with anyone who hunts.

The third question attempted to measure the respondent's perception of the size of the New Jersey deer herd. Each was asked, "Do you think there are a lot of deer in New Jersey or not very many?"

Each question was prepared and pretested with the guidance of social scientists at the Eagleton Institute. Additional data included standard demographic and socioeconomic attributes which are routinely collected in political polls. Each respondent is characterized

by sex, age, education, race, income, occupation, occupation of the chief wage earner, religion, social class, and place of residence.

The general population of the State of New Jersey, over 18 years of age (4,783,319 individuals, U.S. Dept. of Commerce, 1971), formed the population from which the data were collected. A sample of 1,218 individuals was selected at random from this population by Opinion Research Corporation using the Random Digit Dial technique. The method operates in the following manner: New Jersey has 19 mutually exclusive telephone directories. The population of each of these 19 geographic areas is known and the total sampling effort was divided among the areas on a proportionate basis. From within each directory the required amount of phone numbers was randomly selected. An integer constant was added to each number to avoid the bias of unlisted numbers. For example, if the number 545-4476 was selected from the directory and the constant was 1 then the number called for the survey would be 545-4477, a number which may or may not be listed. Within each area, an equal number of men and women were polled. The interviewer initially requested the eldest male in the household. If not present the interviewer would request the oldest female, followed by any resident over 18 years of age. Three telephone callbacks were made to each of the original phone numbers before that number was abandoned for an alternate.

Since the interviews were conducted by telephone, the population must be further defined as New Jersey residents who have a telephone at their residence. This restriction deletes approximately one percent of New Jersey households from the study. (U.S. Dept. of Commerce 1972). In addition, there was an overall refusal rate of 12 percent. The cost of removing these biases was judged prohibitive at this exploratory stage.[3]

RESULTS

New Jersey residents are divided with respect to attitude on deer hunting (Fig. 1). Fifty-four percent approve of deer hunting and 38% disapprove of deer hunting, while only 8 percent claim to be neutral on this issue. The standard error of this estimate is 1.3 percent. In May of 1972, then, *a majority of New Jersey residents approved of deer hunting and the margin of approval was at least 10 percent.*

Six respondent attributes—association with hunting, perception of the deer population, sex, religion, occupation of the chief wage earner,

[3] Data were tabulated by Opinion Research Corporation. Statistical analyses and inferences are my own; tempered, of course, by many valuable discussions with my colleagues. Particular thanks should be directed to Drs. Steven Salmore and John Blydenburg of the Eagleton Institute, Dr. Benjamin B. Stout of the Forestry Section, Rutgers University, Dr. J. Richard Trout of the Statistics Center, Rutgers University, and Mr. Thomas McDermott, now a graduate student at Virginia Polytechnic Institute and State University.

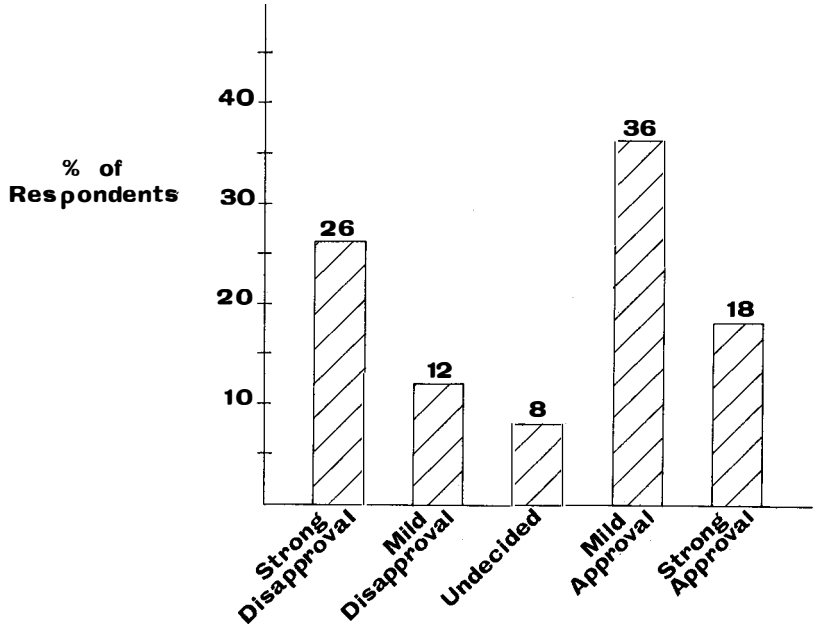


Figure 1.—Attitudes toward deer hunting in New Jersey residents.

and township population density—were significantly related to a respondent's attitude on deer hunting (Table 1). The closer one has been associated with hunting, the more likely he is to approve of deer hunting. The person who feels that there are a lot of deer in New Jersey will approve more frequently than the person who feels there are not many. Men approve of deer hunting more than do women. Protestants and Catholics approve more than Jews and people who claim no religion. People from blue collar households approve more than people from white collar households. People from less populated areas approve more than people from more densely populated areas.

In addition to univariate analysis, multiple regression analysis was used to identify attributes which are related to attitude. Nominal independent variables (such as sex) were treated as dummy variables in this analysis and ordinal variables (age) were treated as continuous variables. The five-point attitude scale was the dependent variable. While not strictly adhering to the general purpose and use of multiple regression, this treatment is valuable in providing additional insight into the interrelationships among the independent variables and the extent to which addition of another variable to the multiple correlation contributes to the explanation of variability in attitude toward deer hunting.

TABLE 1. RESPONDENT ATTRIBUTES WHICH ARE SIGNIFICANTLY RELATED TO ATTITUDE TOWARD DEER HUNTING IN NEW JERSEY RESIDENTS*

Variable (γ)	Level	n	% approve	% undecided	% disapprove
Perception of number of deer in N.J. (.47)	"a lot"	366	70	5	25
	"not many"	452	47	6	47
Association with hunting (.44)	Have hunted; continue to hunt	113	84	1	15
	Have hunted; discontinue hunting	197	71	4	25
	Have never hunted; family or close friends hunt	389	57	9	34
	Have never hunted; family or close friends do not hunt	519	39	11	50
Religion (.42)	Protestant	458	60	7	33
	Catholic	530	55	10	35
	Jew	81	37	9	54
	"None"	108	43	8	49
Sex (.29)	Male	606	62	6	32
	Female	611	47	9	44
Occupation of the chief wage earner (.18)	Blue Collar	407	60	8	32
	White Collar	571	52	9	39
Township population density (.12)	$<$ 1000 people/mi^2	173	63	6	31
	1,000-5,000 people/mi^2	465	56	8	36
	5,000-10,000 people/mi^2	309	52	9	39
	$>$ 10,000 people/mi^2	271	49	10	41

* Attributes included in this table are significantly related ($p < .05$) to attitude using the Gamma (γ) method of Goodman and Kruskal (1954).

Six variables were found to contribute to variation in attitude on deer hunting with regression analysis (Table 2). Five of these, association with hunting, perception of number of deer in New Jersey, religion, occupation, and township density, have already been identified. In addition, age of the respondent was found to contribute to variation in attitude—older people approve of deer hunting more than younger people. Sex of the respondent, found to be highly significant as a single attribute, did not enter the regression model. The reason for this is the relationship between sex and association with hunting. Men have a much stronger association with hunting than do women. In this study, 43 percent of the male respondents reported having hunted at some time compared to 8 percent of the women. The attributes of association and sex are therefore part of the same factor, and after the effect of association with hunting is accounted for, the effect of sex is no longer significant.

TABLE 2. VARIABILITY EXPLAINED IN ATTITUDE TOWARD DEER HUNTING BY SIMULTANEOUS CONSIDERATON OF RESPONDENT ATTRIBUTES. ORDER OF ATTRIBUTES DETERMINED BY MULTIPLE REGRESSION ANALYSIS

Attribute	F ratio	Cumulative R^2
Association with hunting	101.27	0.095
Perception of number of deer in N.J.	40.10	0.128
Religion	27.42	0.149
Occupation of chief wage earner	8.53	0.158
Age	3.79	0.162
Population density	3.96	0.170

While each independent variable is significantly correlated with attitude, a more important question is, "How much variation in attitude toward deer hunting can be explained if all variables are considered simultaneously?" The column designated "R^2" in Table 2 is a measure of the importance of each variable, since it represents the cumulative proportion of variation in the response which is explained by the factors included in the model. Thus, despite significance in a statistical sense, the six factors identified in this study account for only 17 percent of variation in attitude on deer hunting.

DISCUSSION

The single attribute that seems most important in a person's attitude toward hunting is his cultural relationship with hunting. When measured as a four-level ordinal variable of the respondent's direct association with hunters, this attribute was more important than all other attributes combined (Table 2). In addition, the demographic variables (population density, age, occupation and religion) may also reflect a cultural relationship with hunting which is more subtle than the direct measurement made in this study. For instance, a relationship between population density and hunting participation has been demonstrated (Folkman 1963; Peterle 1967; Wright & Lancaster 1972). Rural respondents in this study, even those who have no family or close friends who hunt, would have a greater exposure to hunting and hunters than would urban residents. A similar circumstance might obtain in the case of occupation, where blue-collar occupations have been related to hunting participation (Peterle 1967).

If a cultural association with hunting is important in determining attitudes toward hunting, then the future of hunting in New Jersey is not difficult to foresee. The declining rate of participation in hunting has been well documented (U.S. Bureau of Sport Fisheries and Wildlife 1961, 1966; ORRRC 1962; Peterle 1967; Hendee 1969). As fewer people hunt, the opportunity for a person to understand hunting through an association with a hunter will continue to decline. More of the population will be classified in the fourth category of association with hunting—those who have never hunted and know no hunters. That group, currently representing almost half of New Jersey's population (42%), is generally opposed to hunting. Given a continued decline of hunting participation and no change in attitudes of those who have not known hunting as a part of their cultural heritage, sport hunting is destined to face increasing pressure in New Jersey.

Cultural association with hunting, however, may be less important

than other factors not identified in this study. All respondent attributes accounted for only 17 percent of variability in attitude, leaving a large amount of variability yet to be explained. While much of that variability may involve measurement error inherent in sociological research, ideological variables are certain to be important. The relative importance of "perception of number of deer in New Jersey" suggests that an exploration into such areas as attitudes toward endangered species, guns, violence, etc. may add a great deal to understanding attitudes toward hunting.

LITERATURE CITED

Clarke, C. H. D.
1958. Autumn thoughts of a hunter. J. Wildlife Mgmt. 22(4):420-427.
Folkman, William S.
1963. Levels and sources of forest fire prevention knowledge of California hunters. USDA Forest Serv. Res. Pap. PSW-11. Pac. Southwest Forest and Range Exp. Sta., Berkeley. 22 p.
Goodman, L. A. and W. H. Kruskal.
1954. Measurements of association for cross classification. J. Amer. Statistical Assn. 49:732-764.
Hendee, John C.
1969. Appreciative versus consumptive uses of wildlife refuges: Studies of who gets what and trends in use. Trans. 34th N. Amer. Wildlife and Nat. Resour. Conf. 34:252-264.
New Jersey Dept. of Environ. Prot.
1972. Annual Report, Div. of Fish, Game, and Shellfisheries. Trenton, N.J. In press.
Outdoor Recreation Resources Review Commission.
1962. National Recreation Survey. Study Rep. 19, 394 pp.
Peterle, Tony J.
1967. Characteristics of some Ohio hunters. J. Wildlife Mgmt. 31(2):375-389.
Tillet, Paul.
1963. Doe Day: The antlerless deer controversy in New Jersey. Rutgers Univ. Press. New Brunswick, N.J. 126 pp.
U. S. Bureau of Sport Fisheries and Wildlife.
1961. National survey of fishing and hunting, 1960. Circ. 120, 73 pp.
U. S. Bureau of Sport Fisheries and Wildlife.
1966. National survey of fishing and hunting, 1965. Resource Pub. 27, 76 pp.
U. S. Dept. of Commerce.
1971. 1970 Census of Population: General population characteristics—New Jersey. PC(1)-B32 N.J. Washington, D. C. 203 pp.
U. S. Dept. of Commerce.
1972. Statistical abstract of the United States. 1972. Washington, D. C. 1008 pp.
Wright, G. A. and Joel R. Lancaster.
1972. A spatial analysis of public attitudes toward hunting and firearm usage in middle Tennessee. Presented at 26th Ann. Conf. S.E. Assn. of Game and Fish Comm. Knoxville, Tenn.

TERRITORIALITY AMONG HUNTERS—THE POLICY IMPLICATIONS[1]

JACK WARD THOMAS
USDA Forest Service, Amherst, Massachusetts; and

JAMES C. PACK
West Virginia Department of Natural Resources, Elkins; and

WILLIAM M. HEALY, JOHN D. GILL, AND H. REED SANDERSON
USDA Forest Service, Morgantown, West Virginia

While studying responses by hunters and wildlife to timber-management practices, we interviewed people who hunted in a large forested tract during each of four consecutive years. People who hunted more than once in the same location within the tract seemed to differ from those who, so far as we know, hunted a location only once.

We reasoned that the person who hunted the same location repeatedly had established that area as his home range for hunting. Because familiarity with the home range is advantageous to predators in many ways, home-range hunters would probably see and kill more game than transient hunters. And if home-range behavior progressed to territorial behavior (defense of the home range), the defensive behavior might flare up when the territorial hunter felt that his home range was threatened by change. If so, differences between home-range hunters and transient hunters would have policy implications in management of forest land.

We tested part of this reasoning by comparing questionnaire data from the two kinds of hunters, home range and transient, and we drew some conclusions about territorial behavior.

STUDY AREA AND METHODS

The study area was bounded by the public roads and a connecting private road which encircle Middle Mountain in Pocahontas and Greenbrier Counties, West Virginia. These roads enclose about 23,500 acres, including a ridge 18 miles long by about 2 miles wide. The ridge is almost completely forested and is in national forest ownership except for farmlands and camp lots along parts of the lower slopes. There were no public access roads within the area. Traffic routes for vehicles entering or leaving the area were such that nearly all vehicles had to pass one of two points.

Interview stations were set up at these points during the 1967 through 1970 hunting seasons. Data for 1967 are not presented here

[1] This was a cooperative study between the USDA Forest Service, Northeastern Forest Experiment Station and Monongahela National Forest, and the West Virginia Department of Natural Resources; Pittman-Robertson Project W-39-R.

but were used in revising the original questionnaire and in selecting the sampling days within the subsequent hunting seasons. During the small-game[2] seasons of 1968-70 the stations were operated every day of the first week, and thereafter on every Saturday and one other randomly selected week day, and on every Sunday morning. A similar schedule was used during the deer seasons. Questionnaire pre-test data (1967) indicated that about 90 percent of the hunters using the area could be interviewed by operating both check stations on the above days.

Most hunters driving past the interview stations were stopped and asked where they had hunted. Those who had hunted on the study area were asked their names and addresses, how many years they had hunted—in the aggregate and on Middle Mountain—their ages, how many hours they had hunted on this particular trip, and the numbers of game they had seen and killed. Each hunter was shown a map of Middle Mountain and, with help from the interviewer, was asked to trace the route followed during his hunt and to mark the locations

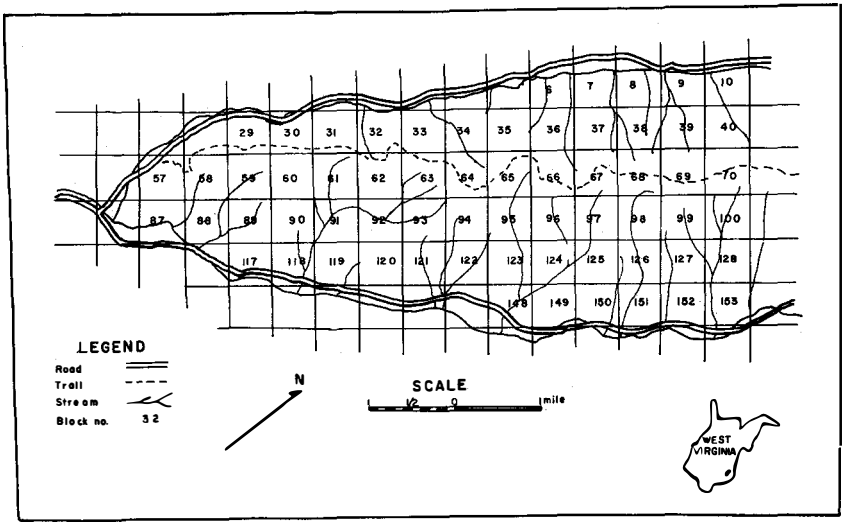


Figure 1.—Study location and part of the map and overlay grid used in locating hunter activities.

where game was seen (Fig. 1). After the interview, a grid was placed over the map, dividing it into 166 numbered square blocks, each of 160 acres. The information for each hunt was coded by block number.

Each hunter was also asked why he had hunted where he did, if the

[2] Small game includes gray squirrels (*Sciurus carolinensis*), fox squirrels (*S. niger*), ruffed grouse (*Bonasa umbellus*), and wild turkeys (*Meleagris gallopavo*).

Oklahoma Cooperative Wildlife Research Unit
404 Life Sciences West
Oklahoma State University
Stillwater, Oklahoma 74074

area chosen was his first choice, if he intended to return to that area, and, if he did not intend to return, why not. The questions were not multiple-choice, but the interviewer put the hunters' responses into categories derived from the questionnaire pre-test. These categories included almost all the answers.

During the interviewing we talked with many of the same hunters year after year. We suspected that these people were regularly hunting the same areas and that they were more successful than hunters we saw only once. To test this, we traced all hunters interviewed in 1968 through the 3-year period. Those who were re-interviewed at least once (either later in 1968 or in subsequent years) were separated from those who did not return. The activities of hunters interviewed more than once were determined by comparing the block numbers for each visit. We considered the hunter to have returned to the same area if more than one-half of the blocks were the same for each visit.

To determine if the returning hunters were more successful than the non-returning hunters, we compared the experience, behavior, game seen, and game killed by each type of hunter in 1968. The interviews were first sorted into two groups: hunters who hunted only once, and hunters who hunted the same location more than once. These groups were further subdivided into small game and deer hunters, giving a total of four classes of hunters. Comparisons were made among all four classes of hunters, but only the first hunt of returning hunters was included. The comparisons were made for 1968 only because game populations differed among years.

Because our sampling plan yielded a nearly complete enumeration of the Middle Mountain hunters, the standard error of any estimate will be small. Therefore, we did not compute standard error of the means for the groups of hunters.

RESULTS

The number of hunters interviewed, as we classified them, were:

1,139 hunted in 1968	(100 percent)
747 hunted only once, in 1968	(64 percent)
392 hunted more than once, 1968-70	(36 percent)
340 hunted same location more than once	(30 percent)

The sample included 52 people (392 minus 340 above) who returned to hunt somewhere on Middle Mountain but did not hunt in the same location twice. They were excluded from our analysis to focus attention on the more distinctly different groups: the 747 nonreturning hunters, and the 340 whom we call "home-range" hunters.

Among the home-range hunters, 87 percent picked a favorite location and hunted only there in each hunting trip, 12 percent visited two areas, and 1 percent visited three. None went to more than three locations.

Home-range hunters averaged more hours per trip (20 percent), had more years of total hunting experience (35 percent), and more experience hunting on Middle Mountain (41 percent) than did nonreturning hunters. They also hunted more blocks per trip (11 percent), but they hunted fewer blocks per hunting hour (11 percent).

We rated hunter success per trip and per hour on two criteria: game seen and game killed. Per trip, home-range hunters saw more game of all species than nonreturning hunters saw. The percentage differences were 24 for deer, 31 for turkeys, 36 for squirrels, and 17 for grouse. On a game-seen-per-hour basis, results were mixed: nonreturning hunters held the advantage in deer and grouse seen by deer hunters, and turkeys seen by small-game hunters. However, home-range hunters of either deer or small game had the total advantage (per hour) by seeing 3 percent more deer, 12 percent more turkeys, 18 percent more squirrels, and 3 percent less grouse than nonreturning hunters.

The advantage in home-range hunting is traditionally examined in terms of game harvested. Per trip, home-range hunters took 34 percent more deer, 41 percent more turkeys, 51 percent more grouse, and 7 percent fewer squirrels than hunters who did not return. Per hour of hunting, the differences between hunter groups were less pronounced but still evident; home-range hunters harvested more deer (16 percent), turkeys (26 percent), and grouse (39 percent).

Nonreturning hunters harvested 27 percent more squirrels per hour of hunter effort than did home-range hunters. We believe that the reason was different behavior between home-range and nonreturning hunters. The season was open on squirrels and turkeys simultaneously. Only 2 percent of the home-range hunters who identified themselves as turkey hunters shot squirrels, compared to 7 percent of the nonreturning hunters. Apparently many home-range hunters were hunting only for turkeys, whereas many nonreturning hunters were opportunistic in shooting squirrels while ostensibly hunting turkeys.

Although more than 90 percent of the home-range hunters and nonreturning hunters hunted the area of their first choice, their arrays of reasons for choosing a specific location were different (Table 1). Of the nonreturning hunters, 41 percent selected their hunting area on direct advice from others, and 29 percent because their own judgments indicated "good hunting" or "more game." But 45

percent of the home-range hunters chose their area because of "good hunting" or "more game" and only 20 percent from the advice of others. Home-range hunters (21 percent) were also influenced in their selection of a hunting area by locations of the hunting camps some of them occupied.

Only 5 percent of the home-range hunters and 16 percent of the transient hunters did not plan to return to their hunting areas. "No game" or "poor hunting" were the most common reasons (Table 2).

TABLE 1. RESPONSES GIVEN BY HOME-RANGE AND NONRETURNING HUNTERS TO THE QUESTION OF "WHAT WAS YOUR MOST IMPORTANT REASON FOR HUNTING WHERE YOU DID?"

Response	Percentage of Respondents	
	Home-range	Non-returning
Good hunting—more game	45.2	29.2
Advice from others	20.1	41.0
No particular reason	9.0	16.3
Access to public land	3.1	1.3
Abundance of hunters	0.0	1.2
Conditions related to timber harvest	0.9	0.1
Presence of roads and trails	0.3	0.7
Access to or through private land	0.3	0.3
Lack of other hunters	0.3	0.0
Other reasons	20.7	9.8

TABLE 2. COMPARISON OF RESPONSES OF 17 HOME-RANGE HUNTERS AND 118 NON-RETURNING HUNTERS WHO SAID THEY WOULD NOT HUNT THE SAME AREA AGAIN

Responses	Percentage of Respondents	
	Home-range	Non-returning
Not enough game	64.7	73.6
Too much timber cutting	11.8	4.6
Country too rough	0.0	8.2
Access problems	5.9	1.8
Too many hunters	5.9	0.0
Other reasons	11.8	11.8

DISCUSSION

The propensity of hunters to visit the same area year after year can be thought of as the establishment of a "home-range," in the same sense as the term applies to other mammals (Burt 1943).

From this premise, hunters with established home-ranges would be expected to behave in ways that give them an advantage over transient hunters in harvesting game. Our data indicate that this is generally true. Home-range hunters hunted more hours per trip, had more general and localized hunting experience, and covered more territory, but covered it more slowly than transient hunters. It is tempting just to say that the home-range hunters are more serious about their sport—but is also likely that they have settled into a pattern and are not distracted by either having to look for a suitable

hunting territory or by having to seek the most productive hunting areas within a territory.

It also seems likely that establishment of home-ranges by hunters leads to the spacing of hunters across suitable range. This probably functions through the ability of the hunter to find and kill game rather than through mere crowding of hunters. When questioned as to why they intended to abandon a hunting area, 74 percent of nonreturning hunters and 65 percent of home-range hunters indicated "no game—poor hunting" as the primary reason. Conversely, no nonreturning hunters and only 6 percent of the home-range hunters gave "too many hunters" as the reason (Table 2). Both groups indicated that the number of hunters present was relatively unimportant in choosing an area to hunt (Table 1).

One of the two most common reasons for choosing a hunting area was "advice from others." This might be interpreted as "I came along with my buddy." Though we collected no data on the subject, it was obvious that most of the home-range hunters interviewed over the years were with the same hunting companions.

The idea that some hunters develop a sense of "territory" is not new (Johnson 1943), but it has some new implications for management. A significant portion of the hunters using any management unit are probably "home-range" hunters. Their only common link may be that their hunting ranges fall within the management unit. They probably live outside the management unit, but it is definitely a portion of their environment, which is relevant to their behavior (Horton and Reynolds 1969).

We believe that home-range hunters have a greater interest in their hunting territory than in other comparable areas. Further, they are more apt to want to influence how this land is managed than are other hunters. For some, the reaction to changes in management of their hunting range is comparable to territorial defense.

In the recent and well-documented controversy over even-aged timber management on the Monongahela National Forest (U.S. Senate 1972), much of the opposition was developed by persons brought into opposition by land-management decisions affecting their relevant environments. In discussions, it was said, "Ah, he only got sore because his favorite turkey hunting area was clearcut."

The statement was dismissed as a trivial reason. We believe it should be taken in a different light. This is the reaction that should be expected when a person's home-range is altered.

Territorial or home-range aspects of behavior by hunters and other forest users have definite application in planning for multiple-use land management, and notably in participatory planning—when the managers seek planning advice from various constituencies. For

participatory planning, managers need to identify the constituent groups affected on a spatial basis as well as a functional basis. In the case of hunters—and probably fishermen and other recreationists—it may be a mistake to regard the general group as the constituency. Such groups may be varied in their home-ranges and specifically concerned with their personal environments but much less concerned with large-scale overall plans.

If planning advice is desired, it should be sought in a different manner than in the past. It should be acquired through a smaller scale presentation of plans by informing groups identified with the particular locales of the plans. The most important group of hunters often consists mostly of people who are not local residents. For example, hunters using the Middle Mountain study area traveled an average distance of 110 miles from their homes (Thomas and Pack 1969). This implies that public meetings held in or near a given management unit are likely to miss an important part of the hunting constituency. However, the hunting constituency for a given area can be identified through methods similar to those used in this study, and where participatory planning is an important aspect of management the home-range hunter should be contacted.

Ardrey (1966) presented a provocative thesis on what territoriality may mean in terms of man's behavior. Territoriality of hunters seems to be an instance in which the concept has definite meaning, and Ardrey's words have particular meaning to those who have or remember a favored and much visited hunting home-range.

"It is a matter of surpassing remark . . . what a change in the landscape occurs when you have made a place of your own; how the shape of an oak tree emerges in the darkness to take on that definition which can only be oak; how stars shine brighter . . . ; how the sound of some running brook . . . chants its quiet cadence . . . the smell of leaves, green leaves dampened by dew, but of other leaves also, old leaves, last year's fallen leaves, that sweet, soft odor of death's composition. And then there is that muskiness. There is an animal somewhere."

LITERATURE CITED

Ardrey, R.
1966. The territorial imperative. 390 p. New York: Athenaeum.

Burt, W. H.
1943. Territorial and home range concepts as applied to mammals. J. Mamm. 24(3): 346-352.

Horton, F. E., and D. R. Reynolds
1969. An investigation of individual action spaces: a progress report. Assoc. Amer. Geogr. Proc. 1:70-75.

Johnson, F. W.
1943. Hunter distribution—studies and methods. N. Amer. Wildl. Conf. Trans. 8:392-407.

Thomas, J. W., and J. C. Pack
1969. Joe Typical—profile of a hunter. Outdoor W. Va. 32(1):19-20.

U. S. Senate Subcommittee on Public Lands.
1972. Clearcutting on federal timberlands. Report to the Comm. on Interior and Insular Affairs. U. S. Govt. Printing Office. 13 p.

PERCEPTION OF WILDLIFE HAZARD IN NATIONAL PARK USE

RORKE B. BRYAN AND MICHAEL C. JANSSON
Department of Geography, University of Alberta, Edmonton, Alberta, Canada

During recent years visitation to national parks in both Canada and the United States has increased dramatically. Although the increase has not been uniform, Banff National Park in Canada serves as an example with visitation increasing from 980,069 to 2,305,852 between 1959 and 1970. In Canada much of the increase has occurred in six western mountain national parks in Alberta and British Columbia, Banff, Jasper, Kootenay, Yoho, Glacier and Mount Revelstoke. All serve as major sanctuaries for many species of wildlife, notably the grizzly bear, black bear, moose, cougar, wapiti, mule deer, wolf, bighorn sheep and mountain goat. Rising visitation and developing road networks have increased contact between tourists and wildlife, and the potential for accidents like the killing of two girls by grizzly bears in Glacier National Park, Montana, in 1967 (Russell 1968; Moment 1969a). Such incidents strongly emphasize the conflict of purpose between recreation and nature preservation inherent in the North American concept of national parks. This creates serious management problems for park administrators, for injury and death of tourists inevitably result in increased public pressure for the eradication of mammals such as grizzly bears from the parks (Moment 1969b). Yielding to this pressure could lead to the extinction of species dependent on the parks as sanctuaries while resisting such pressure may jeopardize human life.

Decisions on the status of wildlife in national parks during the next few decades will be crucial. They should be based on accurate factual assessment of the hazards involved, but it is probable that they will be strongly influenced by environmental perception. White (1966) has stated that "at the heart of managing a natural resource is the manager's perception of that resource and the alternatives open to him in dealing with it." In practice these alternatives are frequently limited in controversial matters by public opinion, which in turn is generated by individual perception. It is therefore the situation as perceived rather than reality that governs actions. The width of the gap between perception and reality is thus critical.

Despite its apparent importance in resource management decisions, the exact role of individual perception in decision-making processes is uncertain for study of this role is of recent origin (Burton and Kates 1964; Lucas 1964). A substantial amount of research has been carried out on perception of physical environmental hazards, such as flooding (Kates 1962) and drought (Saarinen 1966), but perception of wild-

life hazards has been largely ignored (Jansson 1970). This is of vital significance in national park planning but is also of broader importance through its influence on land-use policy in agricultural "fringe" areas where wildlife still poses some threat to life and property.

PERCEPTION OF WILDLIFE HAZARD

A questionnaire survey was carried out during 1969-70 in Alberta, Canada, to determine the degree to which wildlife in western mountain national parks is perceived as being hazardous and factors associated with these perceptions, e.g. frequency of visits to national parks, recreational habits, size of residential community and its proximity to wilderness or largely undisturbed areas. Part of the questionnaire focused particularly on bears as the species most likely to generate alarm and pressure for eradication. For example, questions were designed to test knowledge of ecological requirements of bears, their behavior patterns, ability to identify different species, and knowledge of appropriate reactions upon encountering bears. Apart from providing a more complete picture of wildlife hazard perception this information also served as a check on the efficacy of information provided for visitors by the Canadian National and Historic Parks Branch.

The survey of 393 persons was conducted in three Alberta communities. Edmonton, the capital of the province, has a population of over 400,000, and is located 200 miles east of Jasper National Park in a parkland agricultural area. Westlock is an agricultural community of 3,000 inhabitants which lies 50 miles north of Edmonton near the "agricultural fringe" and close to the Swan Hills, the only location in southern Canada outside the Cordilleran massif having a resident population of grizzly bears. The bears here are believed to number between 30 and 60 and may be a remnant of the formerly abundant population of plains grizzlies which once inhabited most of the western great plains of North America (Soper 1964). The third community, Jasper, is a recreation and transportation center situated 230 miles east of Edmonton in Jasper National Park. This park, established in 1907, is one of the largest in the Canadian national park system, and retains an indigenous fauna of grizzly and black bears, cougar, wolves, wapiti, moose and deer, many of which frequently enter Jasper townsite. The town is situated on one of the major trans-Canadian routeways and has a population of approximately 3,000.

RECOGNITION OF WILDLIFE HAZARD

The hazard from bears, particularly grizzlies, has been established by incidents such as the Glacier killings. During the survey period

several encounters occurred in the area, in one of which two guides from Jasper were severely mauled by a sow grizzly near the northern boundary of the national park. This was sensationally treated by news media and may have had some effect on responses. Despite such encounters the real hazard from bears in national parks is not large, even where they are still quite numerous. Herrero (1970a, 1970b) has observed that between 1872 and 1970 only five people are known to have been killed by grizzly bears in North American parks, a mortality rate of one per 30 million visitors. In the same period 77 injuries occurred, or a rate of one per two million visitors. In view of these statistics the grizzly bear hazard would appear to have been overemphasized in press reports.

Since 1970, when the study was completed there have been no deaths in Canada attributable to the grizzly; however there have been at least six contact incidents in the national parks. A longer time period would be necessary to say that a trend towards increasing incidents is definitely established. Increasing public and press awareness appear to prompt the reporting of minor incidents that may, in fact, have occurred for years.

Hazard from ungulates receives little news coverage, but exists nonetheless. Simply because of its size, an enraged bull moose is a formidable animal, quite capable of causing severe injury or death to human beings. Mule deer and wapiti are less obviously dangerous but as Fuller (1961) has pointed out, even these "gentle" animals have been known to overcome hunters; if cornered both are well-armed with sharp hoofs.

The cougar, or mountain lion, which includes large mammals such as deer amongst its prey, is obviously capable of killing a human being. It is, however, extremely shy and alert so that sightings are rare, and the likelihood of an attack is therefore small. Nevertheless the potential danger is indicated by the death of a child near Jasper National Park in 1966, and an attack on a woman in Kootenay National Park in 1970.

The discussion above indicates that a realistic ranking of species by hazard is: grizzly bear, black bear, cougar, moose, mule deer and wapiti. Cougar is rated as less hazardous than bears because of infrequent contact, and likewise wapiti are encountered somewhat less frequently than mule deer. The most important point is that the gap between bears, cougar and the ungulates is comparatively small. It is further reduced by the fact that ungulates are in more frequent contact with people and may therefore cause a comparatively high percentage of injuries, although many may not be serious.

Ungulates in the national parks have caused property damage and minor human injury. Many of the injury cases have not been officially

recorded because of a lack of need for medical attention. However if ungulate-automobile incidents are considered, the number of serious injuries and deaths exceed injuries and deaths caused by all other animals.

HYPOTHESES CONCERNING PERCEPTION OF HAZARD

A number of hypotheses concerning the accuracy of perception of wildlife formed the basis of the content and structure of the questionnaire. Briefly stated the first hypothesis is that there is a relationship between the accuracy of perception and the frequency of contact with wildlife. Those with higher frequency of contact have more accurate perceptions. It then follows that those living in small rural communities, and thus probably having more chances for wildlife contact, would have more accurate perceptions than city dwellers. Those living within a national park would have the most accurate perception because of the very high frequency of contact. In addition the contacts of the park residents with wildlife would often be marked by atypical animal behavior which would amplify the perceptions of residents to the specific situations confronting park visitors. This series of hypotheses when applied to the three sample groups would suggest an ascending order of accuracy of perception as follows: Edmonton < Westlock < Jasper.

It is also hypothesized that those who are involved in wildlife connected activities, e.g. hunting, will have more accurate perceptions than those who don't participate in wildlife connected activities. In a similar vein it is hypothesized that frequent park visitors will have more accurate perceptions than nonvisitors. Both of these hypotheses are similar to the basic hypothesis that they relate frequency of contact with wildlife to accuracy of perception.

QUESTIONNAIRE RESULTS

All respondents in the questionnaire survey were asked to rank the six species discussed by relative hazard. These rankings are shown in Fig. 1, in which respondents are grouped by locality of residence, frequency of visits to national parks, and participation in hunting. They provide a basis for testing several hypotheses concerning wildlife perception. Locality of residence is clearly important; responses from Jasper residents differed significantly from those of Westlock or Edmonton residents at the 5 percent level (Chi-square test), and most accurately reflected the reality of hazard, particularly from ungulates. This accuracy undoubtedly reflects the opportunities which Jasper residents have for contact with most of the species under circumstances in which the animals' natural fear of man has been

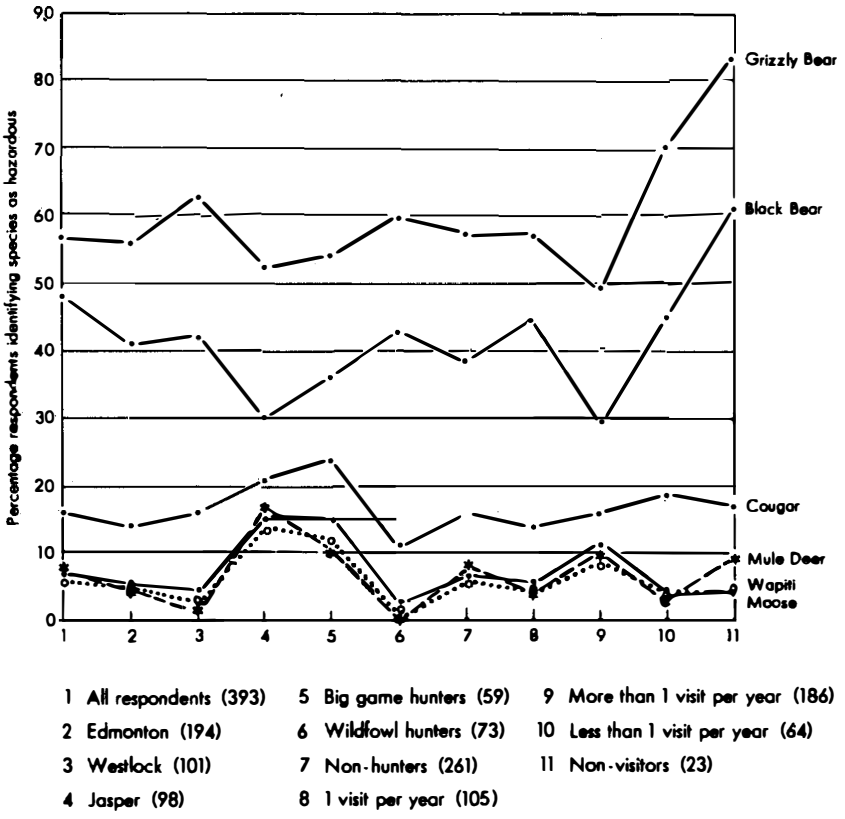


Figure 1.—Hazard ranking for six mammal species found in western Canadian mountain national parks.

greatly reduced. It is interesting that Edmonton residents were slightly more accurate in perception than those from Westlock. This appears to refute the hypothesis that perception of wildlife hazard will decrease in accuracy as the size of community increases. The hypothesis cannot be rejected entirely for both communities are unusual; Edmonton residents have abundant opportunity for travel to natural areas in which contact with wildlife is maintained while Westlock residents appear to reflect the proximity of the Swan Hills and its grizzly population in their responses.

The hypothesis that accuracy of perception of wildlife hazard is a function of frequency of contact with wildlife is supported by data from participants in hunting. Big-game hunters showed the most accurate perception, comparable to that of Jasper residents. It is

difficult to explain the responses of wildfowl hunters which were substantially less accurate than those of nonhunters. Other factors were involved, as a disproportionately large number of wildfowl hunters (76.7%) lived in Westlock. It also reflects the large number of nonhunters who live in Edmonton but who still have frequent contact with wildlife through visits to national parks. Among Edmonton residents 73.2 percent visited a park one or more times per year while the corresponding figure for Westlock residents was 50.5 percent.

The influence of frequency of visits to national parks is shown by the four groups identified in Fig. 1. A fifth group containing those who passed through national parks along transcontinental routeways was not included in analyses. The perception of respondents who visit parks more than once a year most closely approximates reality, and accuracy clearly declines with the frequency of visits.

Although many people recognize the existence of wildlife hazard they do not necessarily feel personally endangered. The responses to a question on feelings of personal endangerment show the same broad pattern as the hazard ranking, perception of hazard increasing as contact with wildlife decreases. Only 12 percent of the complete sample felt endangered; however 12 percent of the Westlock residents, 19 percent of the wildfowl hunters, and a rather surprising 30.4 percent of those not visiting national parks felt endangered. The last figure is out of all proportion to reality as indicated by Herrero's (1970a) data. There is no doubt that hazard perception is an active deterrent to park use by this group.

AWARENESS OF BEAR BEHAVIOR

All the larger mammals in the western mountain national parks present some hazard, but the greatest danger of severe injury or death does appear to come from bears, and any encounter between bears and humans is potentially dangerous. Whether or not an attack actually follows an encounter depends on a variety of circumstances not all of which are clearly understood. Herrero (1970b) has analyzed grizzly attacks in national parks comprehensively, finding that 91 percent of attacks involved hikers or campers. Attacks on hikers generally followed surprise encounters at close range and often involved sows with cubs. The camping incidents mostly occurred at night and appeared to have involved bears accustomed to feeding at campgrounds or garbage dumps, which had come to associate humans with food.

While 95 percent of the encounters analyzed by Herrero did not involve overt human provocation, human reactions can trigger an

attack or influence the extent of injury. There is no universal agreement on the behavior appropriate to encounters with bears, but certain reactions are generally held to be unwise. Attempting to flee is pointless in view of the speed of the grizzly; such attempts may simply enrage the bears and turn testing charges into genuine attacks. It is significant that 54 percent of the attacked hikers in Herrero's study were attempting to flee. Tree climbing is likewise ineffective; although adult grizzlies do not usually climb, they can reach with ease to eight or ten feet above the ground. The most highly recommended reactions are to remain still or to "play dead," both of which require some presence of mind or coolness.

REACTIONS ON ENCOUNTERING BEARS

Respondents were asked to identify from a list of alternatives the manner in which they would react on meeting bears, distinguishing between black bears and grizzlies. While the actual physical hazard posed by the two species is probably not significantly different, black bears are very efficient climbers so taking refuge in a tree is an inappropriate reaction. In considering the responses shown in Table 1 it is necessary to remember that the reactions are to hypothetical situations and are not necessarily a good guide to actual reactions. This might be evidenced by the large number of multiple responses that have resulted in all group percentages exceeding 100.

All respondent groups made a clear distinction between reacting to the two species, which tended to take two forms. The first was an increased desire to react actively when encountering a grizzly, by running or climbing. This may be interpreted as an instinctive reaction to perceived hazard rather than a reasoned consideration of behavior patterns, although it may reflect in part knowledge of the relative climbing abilities of the two species. The second pattern is an increase in the percentage of respondents choosing to "play dead." This must be interpreted as a reasoned rather than an instinctive reaction.

In general the groups showed the same response patterns as in the first part of the study. Jasper residents were clearly the most knowledgeable of the settlement groups, while big-game hunters and frequent visitors to national parks also showed high awareness of appropriate reactions.

SPECIES IDENTIFICATION AND ECOLOGICAL REQUIREMENTS

In view of the distinction between black bears and grizzlies made by most respondents it is worth considering the general ability to distinguish between the two species. Respondents were asked whether

TABLE 1. RESPONDENTS' REACTIONS IN ENCOUNTERS WITH BEARS (AS PERCENTAGES)

Respondent Group	Climb	Run	Shout	Stand Still	Throw Object	Play Dead	Whistle	Walk Away
Black Bears								
Edmonton	8	8	8	25	4	13	5	40
Westlock	2	14	10	28	3	15	4	35
Jasper	5	3	21	17	5	10	15	55
Big-game hunter	2	0	15	39	3	7	9	48
Wildfowl hunter	6	18	10	22	4	14	4	32
Non-hunter	7	8	12	21	4	14	8	44
Visitor (1 p.a)	5	12	8	30	2	13	5	40
Visitor (>1 p.a)	5	3	18	23	5	12	10	47
Visitor (<1 p.a)	8	11	9	20	2	17	8	38
Non-visitor	9	22	4	22	9	17	0	26
Gizzly Bears								
Edmonton	21	19	8	17	1	16	4	27
Westlock	15	18	8	20	3	20	4	22
Jasper	37	3	4	17	1	38	5	19
Big-game hunter	31	9	3	25	2	19	3	27
Wildfowl hunter	22	15	8	17	1	24	5	25
Non-hunter	23	19	6	15	4	18	1	15
Visitor (1 p.a)	19	22	8	14	1	17	3	27
Visitor (>1 p.a)	30	6	8	21	1	28	5	24
Visitor (>1 p.a)	13	24	6	16	3	19	5	23
Non-visitor	9	17	4	17	4	17	0	22

TABLE 2A. RESPONSES TO QUESTIONS ON BEARS (PERCENTAGES)

	a		b	
	1	2	3	4
Edmonton	25	49	7	12
Westlock	41	59	18	16
Jasper	59	90	3	7
Big-game hunter	64	82	5	3
Wildfowl hunter	33	57	8	18
Non-hunter	31	61	13	12
Visitor (1 p.a)	29	51	13	19
Visitor (>1 p.a)	50	75	6	7
Visitor (<1 p.a)	28	55	8	12
Non-visitor	12	21	23	9

Key:

1 Respondents who have seen a grizzly bear

2 Respondents who can identify a grizzly bear

3 Respondents who believe that bears kill humans for food

4 Respondents who stated that they would feed bears

or not they had ever encountered a grizzly and whether or not they could identify which species has a shoulder hump, which is perhaps the only infallible identifying feature of the grizzly. Responses are shown in Table 2a.

In all groups the number of respondents claiming to have seen a grizzly was smaller than the number who could identify it, so the claims can be assumed to be accurate. On the other hand, the responses do put the distinction made between reactions to black bears and grizzlies in perspective, for ability to identify the difference was generally low. Among respondent groups only Jasper residents, big-game hunters and frequent visitors to national parks scored highly. Even for these groups, it is disconcerting to find that 18 percent of big-game hunters cannot distinguish between a grizzly and a black bear. The results generally followed the pattern of familiarity with wildlife found in the first part of the survey. They tend to confirm Marsh's (1970) suspicions of the degree of proficiency in species identification claimed by respondents in a survey in Banff National Park.

Some attempt was made to determine if respondents had any knowledge of the ecological requirements of grizzly bears, particularly with regard to space. The territorial behavior of grizzlies is not well known although recent telemetric research is now providing some insight. Space requirements vary between individual bears but are believed to average 20 square miles. A slight predominance of respondents chose 24 square miles as the required space, but in general responses were unconvincing.

There is little evidence to support the contention that bears will kill humans for food, but in two recent cases in western Canada, the suspicion was strong. One was at Cadomin, Alberta, in 1959 where a hunter was partially eaten by an emaciated black bear, although it is not known if the bear actually killed the man (Macdonald 1965). The second was near Fort St. John, British Columbia, during the study period, when a hunting guide was partially eaten, and presumably killed, by a very old grizzly. In neither case was there clear proof of killing followed by eating. In view of these incidents and the well-publicized Glacier killings, it is perhaps surprising that so few respondents (Table 2b) felt that bears will kill humans for food. The only groups which diverged markedly from this general response were the residents of Westlock and respondents who do not visit national parks.

ADHERENCE TO NATIONAL PARK REGULATIONS ON FEEDING BEARS

All visitors to the western mountain national parks in Canada are forbidden to feed bears. The Parks Branch has developed an informa-

tion sheet provided for visitors at the time of the survey. Although this has now been substantially expanded it is unequivocal in its recommendations. To test the efficacy of this sheet respondents were asked whether or not they would feed bears. The results in Table 2b clearly show that it is not effective, though it is difficult to detect any pattern in the responses. It is interesting that questioners felt strongly that many respondents did not answer this question frankly so that the responses shown are probably less than the actual percentage of respondents who would feed bears. A number of respondents admitted that they would feed bears although fully aware of the regulations. This is disturbing for it shows complete ignorance of the very real danger involved and a reluctance to believe official advice.

It also highlights the role of perception in the governance of behavior, for it is perception rather than reality that condones very inappropriate actions in the face of potentially dangerous situations. Any incident of feeding could result in serious injury or death and strongly increase pressure to reduce bear populations in the parks.

MANAGEMENT OF INJURIOUS WILDLIFE

Increasing contact between parks visitors and wildlife will inevitably accentuate the need for wildlife management. As indicated in Fig. 2, for bears this may mean trapping and removal, or in some cases destruction. Respondents were questioned on the form of management which they felt to be appropriate for animals which caused property damage or human injury. The results shown in Fig. 2 are very interesting: in all groups a significant majority of respondents believed that animals causing property damage should be removed, but that those causing human injury should be destroyed. In the case of animals which caused property damage the respondent groups most strongly in favor of destroying animals were those having least contact with wildlife, such as the nonhunters and respondents who do not visit national parks. On the other hand, for animals which cause human injury the groups most strongly favoring destruction were those having most contact with wildlife such as residents of Jasper and big-game hunters.

The logical reason for either removing or destroying troublesome animals is that the troublesome behavior will become habitual. There is some reason to believe that animals which cause property damage are likely to do so again (Murie 1948; Davenport 1953), but there is little evidence to indicate that injuring humans is habit-forming. Bears which have become accustomed to humans and to eating at garbage dumps are probably abnormally hazardous and there was justification for shooting the bears involved in the 1967 Glacier National Park killings, as they appeared to have developed dangerous behavior

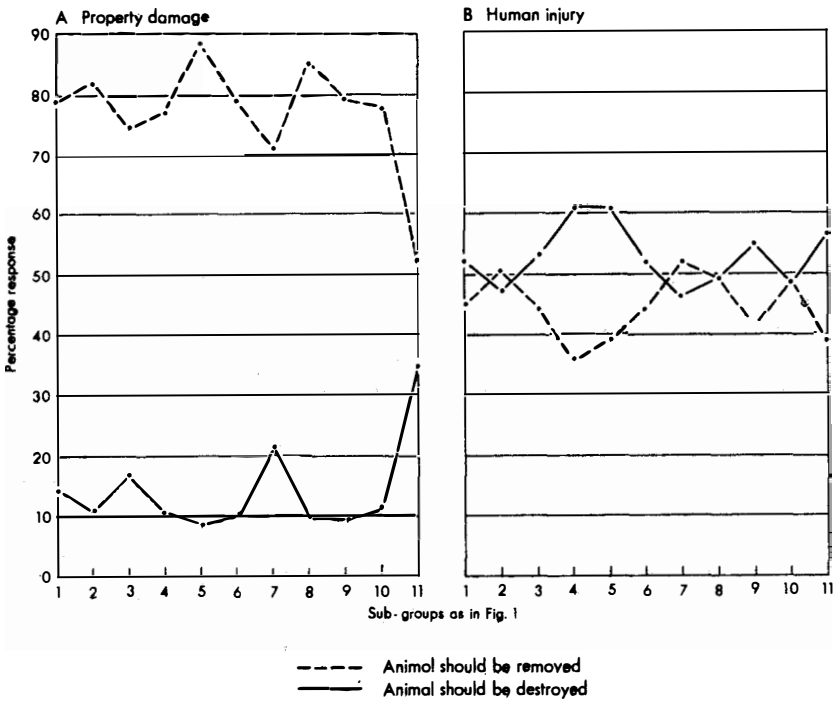


Figure 2.—Preferred management of animals which cause property damage or human injury.

patterns in response to provocation. There is, however, no evidence to suggest that bears which cause injury as a result of a chance encounter in a back area of a park will become habitual killers. There has been little study of this subject, but Corbett (1946, 1948) in his studies of man-eating leopards and tigers in India found that the only animals which became man-eaters were those prevented from normal hunting by age or injury. The incidents at Cadomin and Fort St. John, described above, both conform to this pattern. In view of this, the strong reaction shown by respondents to animals which cause human injury either indicates little knowledge of animal behavior patterns or else the strength of a revenge motive.

CONCLUSION

The evolution of a management policy for any major natural resource is a complex and a prolonged process. Since the establishment of the Banff Hot Spring Reserve in 1885 management policy for the Canadian national parks has undergone a number of changes, but

in the National Parks Act and in all recent policy statements the intention that the parks should serve, at least in part, as wildlife sanctuaries has been clearly established (Dept. of Northern Affairs and Natural Resources 1955; Department of Indian Affairs and Northern Development 1969). This function conflicts with their other established function as centers for outdoor recreation. In the past this conflict of function has not been serious, for visitors to the parks have been few in number, but recent changes in leisure and travel patterns and in outdoor recreation trends have greatly increased visitation. Provision of roads, accommodation and facilities to cater to visitors has reduced the amount of undisturbed habitat available to wildlife, while increasing visitor numbers have led to growing contact between wildlife and humans. If current trends continue pressure on wildlife will increase to a point at which the parks will be unable to meet the requirements of wildlife sanctuaries.

In former years management policies for Canadian national parks have been decided largely by federal authorities without recourse to public opinion. Recently, however, a number of important policy decisons have been influenced by public hearings held across Canada (Dept. of Indian Affairs and Northern Development 1971, 1972). Although doubt has been expressed about the representativeness of opinions expressed at public hearings it does appear that they will be used increasingly as tools to establish park management policy. Decisons on wildlife management will therefore be influenced by public perception of and attitudes towards the various species found in the parks.

The survey described has indicated the existence of substantial inaccuracies in public perception of wildlife species and their behavior patterns. While wildlife perception is undoubtedly complex in origin, the survey indicates that familiarity or contact with wildlife either through residential location or recreational occupation strongly influences its accuracy. On the basis of results it appears reasonable to assume that increasing urbanization and decreasing contact with wildlife will reduce the accuracy of wildlife perception. This inaccuracy, rendered effective by public hearings, may mould park management policy in a way which is not conducive to wildlife protection.

The survey has also shown that methods employed to improve the accuracy of public wildlife perception, particularly with regard to coexistence with hazardous mammals, are not fully effective. A serious danger of injury to park visitors has arisen, which is liable to increase in the future. The survey results clearly show that increased injuries would create strong public pressure to destoy wildlife. To

avoid both of these undesirable results it is imperative that park authorities investigate all methods by which information material could be rendered more effective. The attitudes of respondents towards the feeding of bears indicate that such improvement by itself may be fruitless, and support by stronger punitive action may be necessary.

The future of Canadian national parks as sanctuaries for a variety of species of wildlife is endangered. Protection of this function will require a strong public commitment to wildlife preservation, based on clear and accurate perception of the varying needs of wildlife.

ACKNOWLEDGMENTS

The authors gratefully acknowledge support for this project from the University of Alberta Staff Research Fund. The assistance of students enrolled in resource conservation courses who helped with the survey was also important to the success of the project.

LITERATURE CITED

Burton, I. R., and Kates, R. W.
1964. The perception of natural hazards in resource management, Natural Resources Journal, 3, 412-441.
Corbett, J. E.
1946. Man-eaters of Kumaon, Oxford University Press, London.
Corbett, J. E.
1948. The man-eating Leopard of Rudraprayag, Oxford University Press, New York.
Davenport, L. B.
1953. Agricultural depredation by the black bear in Virginia, Jour. Wildlife Management, 17: 331-340.
Department of Northern Affairs and Natural Resources, National Parks and Historic Sites Service
1955. The National Parks Act, consolidated for office purposes, Queen's Printer, Ottawa, 1955.
Department of Indian Affairs and Northern Development, National and Historic Parks Branch
1969. National Parks Policy, Queen's Printer, Ottawa.
Department of Indian Affairs and Northern Development, National and Historic Parks Branch
1971. Provisional Master Plans for Banff, Yoho, Kootenay and Jasper National Parks. Public hearings held at Calgary, Edmonton, and Vancouver, April 19th-26th, 1971.
Department of Indian Affairs and Northern Development, National and Historic Parks Branch
1972. Preliminary Report of the Public Hearings on the Provisional Master Plans for Banff, Jasper, Yoho and Kootenay National Parks, Queen's Printer, Ottawa.
Fuller, W. A.
1961. Emerging problems in wildlife management, Background papers for the Resources for Tomorrow Conference, Queen's Printer, Ottawa.
Herrero, S.
1970a. Human injury inflicted by grizzly bears, Science, 170, 593-598.
Herrero, S.
1970b. Man and the grizzly bear, Bioscience, 20, 1148-1153.
Jansson, M. C.
1970. Farmer response to depredation by wildlife on agriculture in the Athabasca area. Unpublished M.Sc. thesis, University of Alberta.
Kates, R. W.
1962. Hazard and choice perception in flood plain management. University of Chicago, Department of Geography, Research Paper 78.
Lucas, R. C.
1964. Wilderness perception and use: the example of the Boundary Waters Canoe Area. Natural Resources Journal, 3, 363-374.
Macdonald, W. H.
1965. Bears and people. Land, Forest, Wildlife, 8, 16-32.
Marsh, J.
1970. Bears and the public in our national parks. Canadian Audubon, 32, 43-45.

Moment, G. B.
1969. A new view of conservation: bears and people don't mix. The National Observer, Feb. 24, 22.
Moment, G. B.
1969. Bears and conservation; realities and recommendations. Bioscience, 19, 1019-1020.
Murie, A.
1948. Cattle on grizzly bear range. Journal of Wildlife Management, 12, 57-72.
Russell, A.
1968. The people vs. the grizzlies, Field and Stream, 62, 60-61, 113-119, and 151.
Saarinen, T.
1966. Perception of the dropout hazard on the Great Plains, University of Chicago, Department of Geography, Research Paper 106.
Soper, J. D.
1964. The mammals of Alberta. Hamly Press, Edmonton.
White, G. F.
1966. Formation and role of public attitudes, in Environmental Quality in a Growing Economy, ed. H. Jarrett, The Johns Hopkins Press, Baltimore.

ATTITUDES OF WISCONSIN DUCK HUNTERS ON ALTERNATIVE SPECIES MANAGEMENT REGULATIONS

LOWELL L. KLESSIG
Institute for Environmental Studies, University of Wisconsin Madison; and

RICHARD A. HUNT
Wisconsin Department of Natural Resources, Horicon, Wisconsin

> Waterfowlers define species management as a selective harvest of birds based upon their abundance and vulnerability to harvest restrictions. It is based on two factors: a good understanding of populations *and* the expectation that hunters can and will distinguish one bird from another. (Brakage 1969:1)

By directly testing the ability of hunters to identify ducks on-the-wing, Evrard (1970) has shown that hunters do not have the ability that species management requires. However, Evrard was able to demonstrate that the identification abilities of duck hunters can be improved by training. Two questions still remained unanswered. The first concerned the willingness of hunters to undergo training. The second concerned the willingness of hunters to refrain from shooting at illegal ducks after they had learned to identify them.

In this study hunters were directly asked whether they would be willing to attend training sessions. Two-thirds said "yes." The question of willingness to refrain from shooting illegal ducks was much more subtle. The authors were under no illusion that this question could be answered directly in a mail questionnaire. Instead, various alternative regulations were briefly described and the hunter was asked to give his reaction to each alternative. It was assumed that the hunter would be more likely to obey a regulation he thought was reasonable and the best alternative.

RESEARCH METHODS AND SETTING

The data reported here were obtained as part of a larger study of Wisconsin resident hunters (Klessig 1970, 1972). A stratified systematic sample of hunters was drawn from 1968 license stubs. Sixty-nine percent of the hunters responded to the seven-page questionnaire. Only the responses of the waterfowl hunters to the species management regulations are reported here.

RELATIVE APPEAL OF ALTERNATIVE MANAGEMENT PROPOSALS

Seven alternative regulations were developed after a search of the literature and personal communications with waterfowl managers at the state and federal level. These descriptions were consciously developed to be a compromise between longer descriptions which would have discouraged completion of the questionnaire and shorter descriptions which would not have adequately explained the differences between the regulations. The descriptions of the alternative regulations, as they appeared to the respondent, are shown below under their corresponding titles. The respondent was given the following five-point scale on which to indicate his preference: strongly appealing, appealing, neutral, unappealing, strongly unappealing. For purposes of presentation, that scale has been collapsed to a three part (positive-neutral-negative) scale as shown in Table 1.

Since the goal of this study is to predict acceptance of and adherence to alternative regulations, it is important to understand what type of hunter favors a particular proposal. The following six independent variables were dichotomized as shown in Table 2: Age, Education, Residence, Consistency, Experience, and Success. Consistency was a measure of how regularly the individual hunted. In order to be distinguished as a highly consistent hunter, he had to indicate that he hunted every year from 1964-69 and planned to hunt in 1970. Experience was defined as the total number of years an individual had hunted waterfowl. Eleven or more years was defined as high. Success was defined as number of birds bagged. Earlier studies

TABLE 1. THE ATTITUDE OF WISCONSIN WATERFOWL HUNTERS TO VARIOUS PROPOSED REGULATIONS IN PERCENTAGES

Responses	Simple Regulation	Point System	Bonus System	Straight Species Regulation	Separate Bag Limits	Separate Seasons	Area Regulations
Positive	31	37	40	45	15	16	33
Neutral	10	12	21	16	11	15	20
Negative	59	51	39	39	74	69	47
TOTAL	100	100	100	100	100	100	100
N[1]	(535)	(541)	(529)	(527)	(521)	(530)	(533)

[1] The Ns are slightly different because of missing data.

TABLE 2. THE INFLUENCE OF SEVERAL CONTROL VARIABLES ON ATTITUDES TOWARD THE PROPOSED REGULATIONS IN PERCENTAGE OF WISCONSIN WATERFOWL HUNTERS WHO GAVE POSITIVE RESPONSES[1]

Control Variables	Simple Regulations	Point System	Bonus System	Straight Species Regulations	Separate Bag Limits	Separate Seasons	Area Regulations
Overall positive responses	31	37	40	45	15	16	33
Age							
12-39	29	38	43	46	15	18	30
40 and up	39***	34	34	43	13	12***	40*
Education							
Low (0-11 years)	41	30	28	38	25	10	38
High (12 or more)	30	38	42	46*	14*	17	32
Residence							
Rural (under 2,500)	35	37	45	49	14	16	28
Urban (over 2,500)	27	37	37	42	15*	15	36
Consistency							
Low (1-6 years)	34	37	38	41		16	37
High (7 years)	25***	39**	45	51	17	18	25***
Experience							
Low (0-11 years)	32	39	41	42	13	16	34
High (12 or more)	29	33*	41**	53*	19	18	28***
Success							
Low (0-13 birds)	31	38	40	41	14	15	32
High (14 or more)	29	33	46	65***	22	22	38

[1] Chi Square values determined from comparing positive, neutral, and negative responses:
* Significant at .05 level
** Significant at .01 level
*** Significant at .005 level

(Martin 1966, undated) had shown that a few hunters harvest most of the ducks. In order to identify these very successful hunters, a high success rating required a 1968 kill of at least 14 birds. The relationships between these variables and the hunter's preference for regulations are presented in Table 2 and summarized in the conclusion of the paper.

A. Simple Regulations—No Special Restrictions

Under this proposal, no species would be protected. No identification of species would be required since the bag could consist of any combination of kinds of ducks. However, to protect declining species, only small bags could be allowed.

Simple Regulations merely entail a small bag limit so that endangered species would be minimally harvested. The obvious disadvantage is that abundant species are not harvested to their potential and a large recreational opportunity is not utilized. Thirty-one percent of all waterfowl hunters responded favorably to this regulation.

B. Point System

Under this proposal a hunter could bring home variable bag limits depending on the kind he shot. A hunter would have reached the limit when the last duck he shot brought his total to 100 or more points. Ducks of abundant species would count less

points than birds of declining species. This plan requires in-the-hand identification of the kind of duck one has shot and addition of points to determine if the limit has been reached.

A more complex regulation which requires in-the-hand identification and addition of points was the third most popular regulation when popularity is measured in terms of rates of approval. The Point System assigns a point value to each species and/or sex in inverse proportion to its abundance. The system is premised on an assumption that hunters want to maximize their bag and, consequently, will selectively shoot low-point birds. The hunter reaches his daily bag limit when the last bird he shoots brings his total number of points up to or past a critical number such as 50 or 100. While on-the-wing identification would be needed to maximize his bag, the system has the advantage of allowing an inexperienced hunter to hunt legally by relying on in-the-hand identification. However, this system does not prevent cheating by reordering the bag to have the highest counting duck be the last bird shot and "hoping" to approach 100 points by filling in with low-counting birds. Alternatively, a hunter might illegally discard high-point birds.

C. Bonus System

This proposal like proposals A and B would completely protect few species. Therefore, the basic bag limit would be small to protect declining species. In addition to the basic bag limit, the hunter would be allowed a bonus of a couple of birds of an abundant species. To take full advantage of this bonus, the hunter would be required to identify birds in the air.

The Bonus System was the second most attractive. This proposal establishes a basic bag limit to which a hunter could add a few birds of a particularly abundant species. This regulation, like the Point System, tries to direct hunting pressure away from species that appear to need protection while still not making a violator out of every hunter who shot a bird from one of these species. Ideally, the harvest of abundant species would go up, and the harvest of partially protected birds would go down. Carney and Geis (1968), however, conclude on the basis of 1966 data "that 'bonus regulation' increases the kill of all species present in an area."

Whether or not the regulation promotes management goals, for the hunter to maximize his bag size, he must be able to identify birds on-the-wing. For many of the 40 percent who indicated that the Bonus System was appealing, the conceptual simplicity of the regulation may have been a more important consideration than the need to

identify flying birds. It is noteworthy that only nine percent found this regulation strongly unappealing (uncollapsed data). Note should also be made that two bonus seasons were used in Wisconsin in 1969 during the period of this study.

D. Straight Species Regulation

> Under this proposal declining species would be completely protected. A larger bag limit on the more abundant kinds could then be allowed. Therefore, this plan requires on-the-wing identification of the duck one is shooting at. A hunter who shot a bird of a species on which there was no open season that year would be in violation.

The proposal that appealed to the most duck hunters was the Straight Species Regulation, but even this regulation appealed to only forty-five percent. This regulation declares in any given year what species were legal and which were illegal. There is no further elaboration of regulations within the basic daily bag and possession limits. The proposal is, therefore, almost as simple conceptually as Simple Regulations. However, it is the hardest to abide by since it requires absolute on-the-wing identification. The conceptual simplicity may have attracted the respondents. Familiarity may also have increased relative appeal since this is the type of regulation hunters are most accustomed to.

E. Separate Bag Limits for Ability Groups

> Under this proposal duck hunters would fall into two groups on the basis of whether or not they passed a test on the ability to identify flying ducks at shotgun range. The expert hunters would be allowed to take a larger bag limit, but only of plentiful species. The average hunters who failed the test or did not take it would be allowed a small bag limit of any kind of duck much as they would under proposals A and C.

A system of separating hunters into two classes on the basis of their tested ability to identify ducks (Gale *et al.* 1968), was the least popular of all regulation proposals. Almost three-fourths (74%) of our sample reacted negatively to this proposal which would allow a liberal bag of abundant species only to those "guide or expert" hunters who had passed the test. Under this proposal "novice or average" hunters would be subject to simple small bag limits until they were able to qualify through training and testing. Enforcement problems might arise, however, since mixed groups could exchange birds.

F. Separate Seasons for Ability Groups

Under this proposal all duck hunters would be allowed a small bag limit of any combination of species during a regular season (like proposal A). However, the expert hunter who could pass the identification test would be allowed to hunt in an additional special season in which abundant kinds only could be bagged.

The second proposal that would segregate hunters received an equally negative reaction. Only 16 percent reacted positively to this two-season proposal. In a short regular season all hunters would be allowed to hunt under simple small bag limit restriction. In a special season on one or more abundant species, only those hunters who passed the identification test could participate. Liberal bag limits could be allowed in this season. While this regulation has advantages from the enforcement point of view, it may engender bitterness when it separates hunting parties.

G. Area Regulations

Certain kinds of ducks tend to use particular geographical areas. Under this proposal areas of the state that are used by declining species would be closed to hunting. All duck hunters would be allowed moderate bag limits of any combination of kinds of ducks, but hunters would be restricted in where they could hunt.

Time and place regulations have a long history of use in waterfowl management. Examples include September teal seasons, late scaup and black duck seasons, and Canada goose harvest in quota zones. Such regulations employ the principle that certain species frequent selective areas at selective times of the year. Those areas and times used by declining species would be closed to hunting. This regulation is simple to enforce and tends to minimize the influence of hunters' behavior. Nevertheless, it has at least two drawbacks. First, the weather and behavior of birds are not predictable enough to prevent a large kill of partially protected species. Secondly, those hunters who live in a closed area are likely to be very unhappy about not being able to hunt on familiar terrain. In Wisconsin only one-third of the responding hunters felt they would like area regulations.

DISCUSSION AND CONCLUSIONS

The most apparent generalization in this survey of Wisconsin waterfowl hunter attitudes is that the hunters were not enthusiastic about any of the seven different types of regulations. The two proposals which would separate hunters into two groups on the basis of their ability to identify ducks were least popular. Most hunters

disapproved of the idea that expert hunters should be allowed a Separate Bag Limit or be allowed to hunt in a Separate Season. While challenging and exciting to professional resource managers, this system may be viewed with distaste by lay hunters.

Two types of regulations, which are conceptually simple, were more appealing. Area Regulations and Simple Regulations tend to be most appealing to older hunters with less than a full high school education. However, such regulations have a limited potential for species management.

The three most popular proposals are the most likely to be successfully implemented from both the managers' and hunters' perspective. They are moderately complex and contain the essential principles of species management. Straight Species Regulations, which would make some species legal and others illegal in any given season, was the most popular. The Bonus System, which would set a small basic bag limit and allow a hunter extra birds of an abundant species, was appealing to the second largest group of duck hunters. The Point System assigns different numbers of points to different species in inverse proportion to their abundance, and was third in popularity. While none of these proposals was appealing to half of the hunters, over 50 percent of the hunters suggested that some type of species management be used to deal with declining duck populations. The principle of species management has apparently been fairly well accepted.

These proposals were differentially favored by the younger hunters and rural hunters. With only one exception, the appeal of each of these proposals is positively correlated with education, consistency, experience, and success (Table 2). Those hunters who now have the greatest impact on the resource and who are likely to have the same disproportional impact in the future, endorse species management.

The three most popular proposals determined in this survey require either on-the-wing or in-the-hand identification ability on the part of all hunters. Hunters admitted that many of their companions do not possess this ability. Issuing identification booklets and holding voluntary training programs were most often suggested to remedy this deficiency. Two out of three hunters indicated a willingness to attend training sessions.

Although 40 states have some form of hunter safety instruction, only 18 include waterfowl identification (Wildlife Management Institute 1968). Resource agencies, despite their commanding position for influencing hunters and despite available finances from gun and ammunition taxes, have not shown the leadership in training that the resource deserves.

Apparently most hunters recognize their influence on duck populations and they appear willing to restrict their activity and improve their ability to identify less common species. Translation of this professed attitude into behavior will be the key to successful species management.

LITERATURE CITED

Brakage, G. K.
1968. Waterfowl species management. Presentation to the 5th Annual Meeting of the Illinois Chapter of the Wildl. Society, Mattoon. 8 pp. Mimeo.

Carney, S. M. and A. D. Geis.
1968. The kill of "non-bonus" species in "bonus" bag sizes and the kill of mallards in bag sizes larger than the mallard daily bag limit. U.S. Dept. Interior. Fish and Wildl. Serv. Migratory Bird Pop. Sta. Admin. Dept. 143. 8 pp.

Evrard, J. O.
1970. Assessing and improving waterfowl identification by hunters. J. Wildl. Mgmt. 34(1):114-126.

Gale, L. R., D. Armbruster, T. R. Evans, R. D. Wattersen, R. K. Yancey, A. S. Hawkins, and R. Andrews.
1968. Selective shooting regulations—a new approach. Mississippi Flyway Council Planning Comm. 13 pp. Mimeo.

Klessig, L. L.
1970. Hunting in Wisconsin: initiation, disertion, activity patterns and attitudes as influenced by social class and residence. M.S. Thesis. Univ. of Wisconsin, Madison and Univ. of Wisconsin Center for Resource Policy Studies and Programs. Working Paper #3 (1972). 152 pp. and appendices.

Klessig, L. L., and J. B. Hale
1972. A profile of Wisconsin hunters. Wis. Dept. of Nat. Resour. Tech. Bull. No. 60. 24 pp.

Martin, E. M.
1966. Characteristics of waterfowl hunters: a study of activity categories. U. S. Dept. Interior. Fish and Wildl. Serv. Migratory Bird Pop. Sta. Admin. Rept. 100. 12 pp.

———.
Undated. Characteristics of waterfowl hunters: activity categories for the 1965 season. U.S. Dept. Interior. Fish and Wildl. Serv. Migratory Bird Pop. Sta. Admin. Rept. 126. 10 pp.

Wildlife Management Institute.
1968. Organization, authority and programs of state fish and wildlife agencies. Wildl. Mgmt. Inst. 709 Wire Bldg. Washington, D.C. 28 pp.

WISCONSIN WATERFOWL HUNTER ATTITUDES AND COMMUNICATIONS

TIMOTHY T. EISELE
Department of Natural Resources, Madison, Wisconsin

Over the last twenty years many specialists in the wildlife profession have recognized not only the significance of public attitudes, but also a void of information concerning the natural resource user. And they have called for increased user studies.

Several, including Clement (1969:346), Cottam (1949:335), Gordon (1941), Leopold (1949:225), The Mississippi Flyway Management Planning Committee (1957), and Schoenfeld (1957:70), stressed the importance of the resource user in the successful game management formula. And three recent studies of hunters, by Evrard (1969:26), Klessig (1970:135), and Peterle (1967:378), reiterate the need for continued research.

Specifically in the field of migratory waterfowl management, many of the current problems for waterfowl managers today and alternatives for future hunting regulations are intimately dependent on human behavior.

Knee deep in black marsh muck, the duck hunter is chuck full of opinions, grass roots philosophies, and traditional beliefs. Yet, he has been relatively neglected.

Therefore, I attempted to study and open a channel of communications with Wisconsin duck hunters.

Duck hunters can influence waterfowl management both by their gunning activities and through political pressures, an influence which is magnified by increasing human populations, increasing leisure time, and decreasing natural habitat. In addition, the duck hunter has contributed millions of dollars for the preservation of wetland nesting habitat, refuges, and wintering grounds.

Thus, it is time to remove the fragments of pondweed and primaries from beneath the microscope and replace them with a whole flock of duck hunters.

METHOD

I sent a questionnaire to 665 Wisconsin waterfowl hunters following the 1969 hunting season. The hunters were selected by taking a systematic random sample of the 74,000 hunters applying for a Wisconsin Canada goose hunting permit and then using only those who hunted ducks. Each hunter received a seven-page questionnaire on May 13, 1970 and a free copy of the Department of Interior pamphlet ***Ducks at a Distance.*** The pamphlet was included in consideration for completing the questionnaire.

A second mailing was made to nonrespondents three weeks later, resulting in a total response of 513 duck hunters, or 78 percent. Each hunter was then classified as either an average or ardent duck hunter, depending on the number of years hunted, days hunted and ducks shot per season, club membership, and the hunter's own self-evaluation.

RESULTS

Characteristics

The respondents ranged in the number of years they had hunted ducks from 1 to 75, with an average of 16.5 years. About half (51 percent) had hunted ducks for 12 years or less. The number of days that hunters hunted ducks ranged from 0 to 40, averaging 10.4 days per season. About half (47 percent) hunted ducks less than 10 days during the 1969 season.

The number of ducks shot during the previous season varied from 0 to 75, averaging 11.3 ducks per hunter. Fifty-two percent shot fewer than 9 ducks. And, almost two-thirds (64 percent) of the hunters sampled did not belong to a sportsman's club or conservation group.

Therefore, on the average, the hunters had hunted ducks for 16 years, spent 10 days duck hunting and shot 11 ducks during the previous season. And the majority of hunters were not members of conservation clubs.

Group Communication

The duck hunters and the Wisconsin Department of Natural Resources (DNR) participated in a coorientation experiment. Coorientation is a method of studying communication between two people, first by identifying their attitudes, and second, their knowledge of the other person's attitudes.

Each person in a pair (in this case, two groups) has two sets of perceptions: 1) he knows what he thinks, and 2) he has some estimate of what the other person thinks. And from these two perceptions we can measure the degree of communication between the two people (or groups) using three "measuring sticks" called *agreement, accuracy,* and *congruency,* as seen in Figure 1 (Chaffee and McLeod, 1968).

Agreement is the extent that one person's evaluation of an idea resembles the other person's evaluation of the same idea. *Accuracy* is the degree to which the first person's perception of the second person's evaluation resembles the second person's true evaluation. And, to the extent that one person thinks the other's opinions resemble his own there is *congruency.*

Hunters were presented five attitude questions as part of a 15-question section on attitudes, and then later in the questionnaire were asked how they thought the DNR would answer the same five

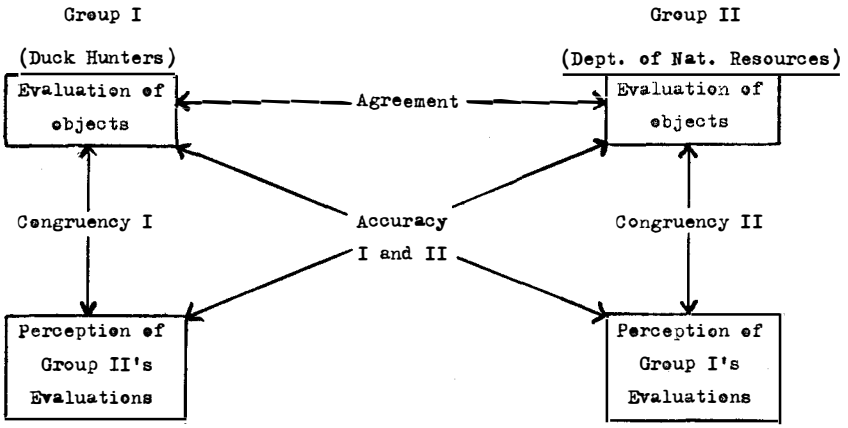


Figure 1.—Measures of coorientation.

questions. Similarly, the DNR was given the 15 questions and then asked to answer how they thought the Wisconsin duck hunters would answer the same five questions. The 10 DNR employees answering the questionnaire were considered to be key people in implementing Wisconsin's duck hunting regulations.

Percentages were used to determine the group response to each question, either favorable or unfavorable, and then subtracted to compare the difference between the hunters and the DNR.

Results showed that DNR accuracy was considerably better than the accuracy of both groups of hunters; that is that the DNR was closer to knowing the hunter response than the hunters were to knowing the DNR response. The DNR scored better on average hunters than it did on ardent hunters. And, of the two hunter groups, the ardent hunters scored better than the average hunters, but only by a small margin.

Agreement differed considerably between the two groups, indicating that disagreement exists between hunters and the DNR. Of the two hunter groups, the ardent hunters were closer in agreement to the DNR than were the average hunters.

Congruency, as you can see in Figure 1, is more an expression of a person's "psychological-self" rather than true communications. However, it is interesting that the hunters saw themselves as being closer in "perceived agreement" to the DNR than the DNR did to the hunters. Average hunters, in fact, saw their viewpoint as being very similar to that of the DNR, whereas the DNR saw its opinions as being closer to those of the ardent hunters.

Overall, the coorientation experiment showed that both the hunters and the DNR thought their views were closer to each other's than they actually were. And, the DNR knew the hunter's attitudes more often than the hunters knew the Department's attitudes.

Information Sources

Each hunter was asked to indicate how many sources gave him information on duck hunting regulations, spring breeding conditions, and predictions for the coming hunting season, as well as which one source he primarily relied upon for each of these three subjects.

The most common number of sources used to obtain information on the Wisconsin duck hunting regulations was three, with 85 percent of the hunters using from two to six sources. The one primary source used most often was the DNR, followed by federal publications and newspapers, with 88 percent of the hunters relying primarily on these three sources for information on regulations. This same relationship held true for both ardent and average hunters.

Hunters didn't use as many sources for information on spring breeding conditions. The most popular number of sources was two, as 84 percent used between one and four sources. The one primary source for breeding conditions was usually newspapers, followed by the DNR, and magazines.

The most common number of sources used to obtain information on the outlook for the coming duck hunting season was three, with 87 percent using between one and five sources. The primary source was predominantly newspapers, followed by the DNR, and magazines. Interestingly enough, both ardent and average hunters ranked newspapers and the DNR in one-two order, but ardent hunters listed federal publications third, whereas average hunters listed magazines third.

From this information it appears that the sources used by these Wisconsin hunters varied by topic, but that newspapers, the DNR, and magazines were the top three primary sources for each subject. And the usual number of sources that hunters used to get information on each topic was three.

Each hunter was also asked if he found any one source of waterfowl information more objective than the others. A majority of 69 percent answered negatively (that they didn't find any one source more objective), 27 percent did find one source more objective, and 4 percent failed to answer the question. Those 119 hunters finding one source more objective listed that source as the DNR 23 percent of the time, newspapers 20 percent, clubs 17 percent, and magazines 16 percent of the time.

Hunters were also asked if any of the writers or broadcasters that

reported waterfowl information to them had a background in game management, wildlife ecology, or conservation. Only 19 percent could answer yes to that question, 6 percent said no, and 73 percent admitted they didn't know.

And, in answer to an optional question concerning the ways they would express their opinions to the DNR, most hunters (103) would write a letter, with the second most popular choice (23 hunters) being a talk to an area game manager or warden.

Attitudes

Each duck hunter was asked to express his áttitude, in an agree/disagree manner, for 15 statements dealing mostly with hunting regulations. Three typical examples are:

1. Simple hunting regulations should be used in Wisconsin—that is, where no species gets special protection and hunters don't need to identify ducks, but where small bag limits might be necessary. Response: 67 percent disagreed, 24 percent agreed, 8 percent neutral.
2. Species regulations should be used in Wisconsin—that is, completely protecting declining species, thereby requiring in-flight identification by hunters and probably larger bag limits on the more abundant species.
   Response: 71 percent agreed, 17 percent disagreed, 12 percent neutral
3. Circle the choice you prefer: A) One extra bird in the bag, or B) Ten extra hunting days.
   Response: 67 percent preferred ten extra days and 31 percent preferred one extra bird.

Response to the 15 attitude questions showed that hunters were clearly against the simple type of hunting regulations that fail to differentiate between species, but were strongly in favor of species-oriented regulations. And, two specific types of species regulations (the point system and bonus system) were favorably supported by the duck hunters but not as enthusiastically as species regulations in general.

Further suggestions for dividing hunters into ability groups received strong opposition, as did a proposal to divide the state into major zones for regulations. It appeared that hunters wanted one set of "regs" to apply to everyone, everywhere in the state.

A majority of 59 percent of the hunters were in favor of closing certain lakes and marshes to other boat users during the duck season, and a strong majority of 72 percent were against the idea of Wisconsin waterfowl hunters contributing money to help reduce the cost of crop damage by waterfowl.

When asked whether they thought sky-busters and law-breakers would probably not pass a waterfowl identification test and thus be eliminated from hunting, 43 percent agreed and 11 percent were neutral. And, 54 percent disagreed that waterfowl can be stockpiled for future use by not hunting them for a while.

Respondents agreed with the decision by the DNR turning down a split duck season at the expense of several hunting days. The majority (58 percent) also said that they would hunt regardless of the low bag limits and short seasons, and accordingly preferred extra hunting days rather than an extra bird permitted in the bag limit.

The critical number that might cause many duck hunters to quit duck hunting was a bag limit of less than four ducks daily or a season length shorter than 30 days.

Ardent and average hunters consistently took the same position on most attitude questions, but with ardent hunters usually stronger in their support or opposition.

Knowledge

Eleven statements, representing principles of waterfowl management and factors influencing waterfowl hunting seasons, were given to the hunters to measure their knowledge of the technical aspects behind duck hunting. Although the statements were presented in an agree/disagree format it was really a true/false test, with each statement having one correct answer. For example, four statements and responses were:

1. Most of the ducks not shot during the hunting season will die anyway within a year, due to old age, disease, predators, or accidents.
   Response: 93 percent correctly disagreed and 7 percent agreed.
2. Peak fall duck populations occur in Wisconsin between October 10 and November 10.
   Response: 89 percent correctly agreed and 9 percent disagreed.
3. Adult breeding ducks have a strong homing tendency and frequently return to the marsh where they were raised.
   Response: 80 percent correctly agreed and 19 percent disagreed.
4. Hunters can always tell a drake from a hen mallard, because during the hunting season the drake ***always*** has a green head.
   Response: 56 percent correctly disagreed and 42 percent agreed.

The test scores varied from a low of 4 questions (36 percent) correct out of 11, to the high of 11 (100 percent) correct. The scores were higher than expected, as the score most often received was 8 correct. The breakdown of ardent and average hunters showed that a greater proportion of ardent hunters scored 8 or more correct than

did average hunters, with the average hunters placing a relatively greater proportion in the category of 4 to 7 correct. In addition, hunters with high scores were more likely to return questionnaires before the second mailing, had hunted for more years, and hunted the most days per season.

SUMMARY

The great majority of hunters indicated a willingness to express their opinions and their interest on the waterfowl resource and hunting regulations.

The hunters sampled averaged 10 days duck hunting and 11 ducks shot during the 1969 season and had hunted ducks for an average of 16 years. Both the Department of Natural Resources and the hunters thought their attitudes were closer alike than they actually were, and hunters relied primarily on newspapers, the DNR, and magazines for waterfowl information. Hunter attitudes were favorable to species-oriented regulations and hunters preferred extra hunting days per season rather than an extra bird permitted in the bag limit. In addition, hunters averaged 8 questions correct out of 11 on a test of principles behind hunting regulations and waterfowl management.

This study was an attempt to open a channel of communications with duck hunters while at the same time studying the hunter. For, by studying the resource user we can lay a foundation for an effective exchange of ideas between professional resource managers and resource users, ultimately benefiting the resource.

LITERATURE CITED*

Chaffee, S. H., and J. M. McLeod.
1968. Sensitization in panel design: A coorientational experiment. Journalism Quarterly 45(4):661-669.

Clement, R. C.
1969. Instincts, laws and ducks. Trans. N. Am. Wildl. and Natur. Resources Conf. 34:346-350.

Cottam, C.
1949. Further needs in wildlife research. J. Wildl. Mgmt. 13(4):333-338.

Evrard, J. O.
1969. Assessing, improving and applying the ability of hunters to identify waterfowl on the wing. M.S. thesis. Univ. of Wisconsin, Madison.

Gordon, S.
1941. A sampling technique for the determination of hunters activities and the economics thereof. J. Wildl. Mgmt. 5(3):260-278.

Klessig, L. L.
1970. Hunting in Wisconsin: initiation, desertion, activity patterns, and attitudes as influenced by social class and residence. M.S. thesis. Univ. of Wisconsin, Madison.

Leopold, A.
1949. A Sand County almanac and sketches here and there. Oxford Univ. Press, New York.

Mississippi Flyway Management Plan Committee
1957. Mississippi Flyway management plan. Bureau of Sport Fisheries and Wildlife, St. Paul, Minnesota.

Peterle, T. J.
1967. Characteristics of some Ohio hunters. J. Wildl. Mgmt. 31(2):375-389.

Schoenfeld, C. A.
1957. Public relations aspects of wildlife management. J. Wildl. Mgmt. 21(1):70-74.

* Support for data analysis was provided by the University of Wisconsin Graduate School.

A METHOD OF UTILIZING PERSONAL VALUE INFORMATION FOR ASSESSING ADMINISTRATIVE CHANGES ON PUBLIC LANDS[1]

DAVID L. GROVES
Assistant Professor of Forestry and Wildlife, Virginia Polytechnic Institute and State University, Blacksburg, Virginia; and

CHARLES T. CUSHWA
Program Leader, Institute of Northern Forestry, College, Alaska; and

JAMES S. LINDZEY
Leader, Pennsylvania Cooperative Wildlife Research Unit, The Pennsylvania State University, University Park, Pennsylvania

INTRODUCTION

Natural resource agencies have a responsibility to manage public land to meet the broadest range of user and public needs. With increasing population and industrialization, resources must be allocated more efficiently and effectively to reduce waste and to better achieve desired objectives. Management agencies need methods to assess the effects of management alternatives upon the value of public land. This case study was undertaken to demonstrate how "personal value" information, *i.e.*, the way an individual thinks (cognitive component), feels (affective component), and acts (action tendency component), can be utilized to make decisions about future land uses.

The area used for this case study was State Game Lands 176, which is six miles west of State College, Pennsylvania, and under the jurisdiction of the Pennsylvania Game Commission. State College, like many other communities, is growing rapidly. New housing developments have already encircled a 700-acre section of Game Lands 176. This land has residential, commercial, and recreational potential. Consequently, it has multiple uses which are potentially of a conflicting nature. The Game Commission is faced with decisions concerning future management of this land and needs methods to evaluate the effect of alternative uses.

Operational methods to determine the personal value of land are not well developed. The resource manager often finds himself in the midst of a controversy among supporters of alternative uses. Frequently, use of the land for recreational purposes are overruled, mainly because there is no quantitative information to support this use. As Cesario *et al.* (1969) put it:

[1] Funds were provided by the National Rifle Association and the Wildlife Management Institute in cooperation with the USDI Pennsylvania Cooperative Wildlife Research Unit, the Pennsylvania Game Commission, and The Pennsylvania State University.

> "In order to allocate land and water resources efficiently among uses that include outdoor recreation it is necessary to determine some measure of value for this use which can be compared with the values for other uses.
>
> Though there is considerable agreement on the nature of the values created, means of measuring them are, by and large, lacking" (pp. 1-2).

Consequently, a method to determine the personal value of resources was developed (Groves 1973), and this is a brief report on its application.

METHODS

Use of Personal Value Information

Value information can be used to help develop policies and programs and/or to give evidence of worth for justification (accountability). Two types of measures can be used for the utilization of value information: gross and net value. Gross value refers to the total worth of an object. This type of measure is not sensitive to change because it only depends upon one measure in time. Net worth is the change in value of a product that has occurred because of an administrative change. Net worth is a better indicator of value because it takes into account efficiency, by assessing the amount of change as a function of cost, and effectiveness, by assessing the amount of change in terms of desired outcomes. A pre-post question design was used so that the net value of specific management alternatives could be determined.

Hypothetical questions were used to simulate administrative changes to illustrate the practical nature of preventive planning, *i.e.,* decisions that are made before the fact and are of an avertive nature, for assessing needs and developing programs to institute change. This type of planning attempts to provide for solution through permanent change, whereas therapeutic planning, *i.e.,* decisions that are made after the fact and are of a treatment nature, usually only provides for a temporary solution to the problem. Planned change can only be achieved through preventive planning.

Measurement and Analysis

Personal values were measured using a semi-structured interview, patterned after a technique developed by Harvey (1970). Responses were quantified using Bloom's and Krathwohl's typologies (Bloom *et al.,* 1956; Krathwohl *et al.* 1964). These typologies are based upon how much an individual knows and how he is able to utilize his knowledge (cognitive component) and how involved he is with the object in terms of emotion (affective component) and action (action

tendency component) (Model 1). The system of analysis used is based upon the grouping of the personal value scores into similar categories using Q analysis (Johnson, 1969). Such a system of analysis permits the identification of homogeneous groups so that interrelations among the component scores do not have an averaging effect upon the total index score.

Index:

Personal values were measured on a component basis and quantitatively indexed as follows (Brown 1970):

$$(C \times W) + (A \times W) + (AT \times W) = \text{Index of Total Worth}^1$$

The weighting factor used for each component was the reciprocal of its standard deviation. Raw weighting factors were multiplied by the smallest weighting factor and rounded to a whole number. The effect of this weighting system was standardization of scores to a common frame of reference. The weighting factor for all components for both the user and general populations was one.

Sampling and Interviewing

To obtain personal value information from representative segments of the population, the local (12 minor civil divisions adjacent to State College) user and general populations were sampled.

A proportionate, stratified, random sampling technique was employed to reduce cost and increase the efficiency of the sample design. Stratifications used for sampling were age, sex, marital status, occupation, and resident types (Sonnenfeld 1966). These variables were factor analyzed using principle component and Varimax methodologies to find interrelationships to reduce the effect of double sampling. Representative variables from each of the factors isolated were used as stratifications. The sample populations were proportionately stratified on the basis of the percentage of the total local population within each strata.

Users of Game Lands 176 were identified and stratifications isolated using sampling techniques similar to those developed by James and Henley (1968). (The sample source included 89% of the total population). A simple random sample of 180 users of State Game Lands 176 was contacted and asked to participate in the study. Of the 180 individuals, 173 (96%) were personally interviewed. Sixty of these individuals were proportionately, randomly selected to represent the user population.

[1] C = cognitive measure; A = affective measure; AT = action tendency measure; W = weighting factor.

Stratifications for the general population were identified using the 1970 Census data. The sample was selected from the Centre County tax records and The Pennsylvania State University student directory. (The sample source included 95% of the total population). One hundred and seventy individuals were randomly selected and 153 (90%) were personally interviewed. Sixty of these individuals were proportionately, randomly selected to represent the general population.

In both the sampling and interviewing, quality control mechanisms such as interview training and respondent's evaluation of the interviewing process, were built into the experimental design.

Reliability of the interviews was checked, using a correlation coefficient and a test-retest design on every fifth person interviewed. There were significant relationships at the .001 probability level between the two interviews for the value components of both populations, indicating the reliability of the interviewing technique.

Interpretation framework

Although there are many frameworks utilized for the interpretation of change, Alkin (1972) has developed a framework that permits examination of the relationships between an agency's structure and processes and the external forces that influence the organization. A unique feature of this framework is its dedication to accountability, (Fig. 1), *i.e.*,

> "Accountability is a negotiated relationship in which the participants agree in advance to accept specified rewards and costs on the basis of evaluation findings as to the attainment of specified ends." (p. 2)

	Who is Accountable	To Whom (primary responsibility)	For What
Goal Accountability	Game Commission	Users and/or the general population	Goal and objective selection
Program Accountability	Regional Management	Game Commission	Development and/or selection of programs appropriate for stated objectives
Outcome Accountability	Field Management level (Game Protectors, Land Managers, Deputies, etc.)	Regional Management	Producing program outcomes consistent with preselected objectives at a performance standard appropriate for the program

Figure 1.—Accountability types (Adapted from Alkin 1972).

RESULTS

The two issues explored were the conversion of Game Lands 176 into a housing development and permitting of motorized vehicles use throughout the area.

Personal Value Groups

Personal value component scores were grouped according to similarity and differences using Q analysis (Johnson 1969). There were two natural groupings in both the user and general populations and these groups were significantly different at the .001 probability level using Mahalonobis D in an F-test framework. Cross tabulation and factor analysis (principle component and Varimax methodologies) were used to obtain the orientation of each group in both the user and general populations. It was found that *P*ersonal *V*alue *G*roup 1 of the general population and PVG 2 of the user population were related to all thre ecomponents. PVG 1 of the user population and PVG 2 of the general population were oriented toward particular components. Even though these groups were similar in structure, they were different with regard to the type and strength of components making up the groups. A coreperipheral value differential was used to interpret these differences. Core values meet the following criterion processes: (1) Cognitive Component—An ability to evaluate causes and solutions in terms of established criteria or, at least, an ability to isolate potential causes and solutions; (2) Affective Component—Involvement with an object enough to build a philosophy of life based upon the commitment or, at least enough to try to convert others to the cause; and (3) Action Tendency Component—A frequent (once a week or greater) activity pattern. Peripheral values are those component elements which do not meet the criterion processes. The component relationships and distribution of individuals for the user population are:

	N	%
PVG 1		
high (core) cognitive = low (peripheral) action tendencies	16	27%
low cognitive = high action tendencies	17	28%
low affective = low action tendencies	5	8%
PVG-2		
high cognitive = high affective = high action tendencies	7	12%
low cognitive = high affective = low action tendencies	15	25%

The component relationships and distribution of individuals for the general population are:

PVG 1		
low cognitive = low affective = low action tendencies	18	30%
neutral cognitive = neutral affective = neutral action tendencies	18	30%
high cognitive = high affective = high action tendencies	3	5%
low cognitive = low affective = high action tendencies	1	2%

PVG-2		
high cognitive= high affective	8	13%
high affective = high action tendencies	3	5%
high affective	9	15%

Conversion of Game Lands 176 into a Housing Development

Comparison of the user's index scores, using correlation coefficients, indicated that there were differences between the existing condition and the conversion of this area into a housing development for both PVG groups (Tables 1a and 2a). Conversion of Game Lands 176 into a housing development would decrease the value of this area (Tables 1b and 2b). *E*xisting *C*ondition and *H*ousing *D*evelopment score patterns were similar, except for the difference in direction. There was, however, a 45% increase in HD cognitive scores, and a 39 percent increase in HD action tendency scores from low to high in PVG 1 (only score changes over 15% were noted). HD scores of PVG 2 were very similar to the EC scores. Since 68% of the users had high action tendencies, this indicated that they would strongly oppose the conversion of this land into a housing development.

Correlation coefficients for both PVG groups of the general population indicated that there were differences between the existing condition and the housing development issue (Tables 3a and 4a). There

TABLE 1. STATISTICAL COMPARISONS PERSONAL VALUE GROUP 1—EXISTING CONDITION, CONVERSION OF GAME LANDS 176 INTO A HOUSING DEVELOPMENT, AND USE OF MOTORIZED VEHICLES ON GAME LANDS 176: USERS

a. Correlation Coefficients, Means, and Average Component Scores

	Existing Condition vs:	Conversion	Motorized Vehicle Use
r		= -0.65	= -0.14
means	= 34	= 7	= 8
average component scores	= 11	= 2	= 3

b. Personal Value Score Pattern Comparisons[1]

Existing Condition C	A	AT	N	%	Conversion C	A	AT	N	%	Motorized Vehicle Use C	A	AT	N	%
+H =	+H =	+L	15	39	-H =	-H =	-H	15	39	-H =	-H =	-H	13	34
										+H =	+H =	+H	2	5
-H =	-H =	-L	1	3	-H =	-H =	-L	1	3	-H =	-H =	-L	1	3
+L =	+L =	+L	5	13	-L =	-H =	-L	5	13	-L =	-H =	-L	4	11
										+H =	+H =	+H	1	3
+L =	+H =	+H	17/38	45/100	-H =	-H =	-H	17/38	45/100	-L =	-H =	-H	15	39
										+H =	+H =	+H	2/38	5/100

[1] C = cognitive; A = affective; AT = action tendency; H = high; and L = low.

TABLE 2. STATISTICAL COMPARISONS PERSONAL VALUE GROUP 2—EXISTING CONDITION, CONVERSION OF GAME LANDS 176 INTO A HOUSING DEVELOPMENT, AND USE OF MOTORIZED VEHICLES ON GAME LANDS 176: USERS

a. Correlation Coefficients, Means, and Average Component Scores

	Existing Condition vs:	Conversion	Motorized Vehicle Use
r		= -0.34	= -0.21
means	= 29	= 8	= 9
average component scores	= 10	= 3	= 3

b. Personal Value Score Pattern Comparisons[1]

Existing Condition C	A	AT	N	%	Conversion C	A	AT	N	%	Motorized Vehicle Use C	A	AT	N	%
+L =	+H	+L	15	68	-L =	-H =	-L	13	59	-L =	-H =	-L	12	54
					-L =	-H =	-H	2	9	-L =	-H =	-H	2	9
										+H =	+H =	+H	1	5
+H =	+H	+H	7/22	32/100	-H =	-H =	-H	7/22	32/100	-H =	-H =	-H	6	27
										+H =	+H =	+H	1/22	5/100

[1]C = cognitive; A = affective; AT = action tendency; H = high; and L = low.

TABLE 3. STATISTICAL COMPARISONS PERSONAL VALUE GROUP 1—EXISTING CONDITION, CONVERSION OF GAME LANDS 176 INTO A HOUSING DEVELOPMENT, AND USE OF MOTORIZED VEHICLES ON GAME LANDS 176: GENERAL POPULATION

a. Correlation Coefficients, Means, and Average Component Scores

	Existing Condition vs:	Conversion	Motorized Vehicle Use
r		= -0.63	= -0.20
means	= 24	= 14	= 17
average component scores	= 8	= 5	= 6

b. Personal Value Score Pattern Comparisons[1]

Existing Condition C	A	AT	N	%	Conversion C	A	AT	N	%	Motorized Vehicle Use C	A	AT	N	%
+H =	+H =	+H	2	5	-H =	-H =	-H	1	3	-H =	-H =	-H	1	3
				semi[2]	-H =	-H =	-H	1	3 semi	-H =	-H	-H	1	3
-H =	-H =	-H	1	3 semi	-H =	-H =	-H	1	3 semi	-H =	-H =	-H	1	3
+L =	+L =	+L	17	43	-L =	-H =	-L	16	40	-L =	-H =	-L	14	35
					-L =	-L =	-L	1	3	+H =	+H =	+H	1	3
										-L =	-L =	-L	2	5
-L =	-L =	-L	1	3	-L =	-L =	-L	1	3	-L =	-L =	-L	1	3
N =	N =	N	18	45	N =	N =	N	11	28	N =	N =	N	8	20
					-L =	-L =	-L	7	18	-L =	-L =	-L	7	18
										+H =	+H =	+H	2	5
										+L =	+L =	+L	1	3
+L =	+L =	+H	1/40	3/102	-L =	-H =	-H	1/40	3/104	-L =	-H =	-H	1/40	3/104

[1]C = cognitive; A = affective; AT = action tendency; H = high; L = low; and N = neutral.

[2]Semi = one component score not in high range, but only one point below.

TABLE 4. STATISTICAL COMPARISONS PERSONAL VALUE GROUP 2—EXISTING CONDITION, CONVERSION OF GAME LANDS 176 INTO A HOUSING DEVELOPMENT, AND USE OF MOTORIZED VEHICLES ON GAME LANDS 176: GENERAL POPULATION

a. Correlation Coefficients, Means, and Average Component Scores

	Existing Condition vs:	Conversion	Motorized Vehicle Use
r		= -0.12	= -0.09
means	= 31	= 9	= 10
average component scores	= 10	= 3	= 3

b. Personal Value Score Pattern Comparisons[1]

Existing Condition C	A	AT	N	%	Conversion C	A	AT	N	%	Motorized Vehicle Use C	A	AT	N	%
+H =	+H =	+L	8	40	-H =	-H =	-H	3	15	-H =	-H =	-H	3	15
				semi[2]	-H =	-H =	-H	5	25	semi -H =	-H =	-H	4	20
										+H =	+H =	+H	1	5
+L =	+H =	+L	8	40	-L =	-H =	-L	8	40	-L =	-H =	-L	7	35
										+H =	+H =	+H	1	5
-L =	-H =	-L	1	5	-L =	-L =	-L	1	5	-L =	-L =	-L	1	5
+L =	+H =	+H	3/20	15/100	-L =	-H =	-H	3/20	15/100	-L =	-H =	-H	3/20	15/100

[1] C = cognitive; A = affective; AT = action tendency; H = high; and L = low.
[2] Semi = one component score not in high range, but only one point below.

would be a decrease in the value of the land were the conversion to take place (Table 3b and 4b). EC and HD score patterns were similar, except for the difference in direction. There was, however, in PVG 1 a 43% increase in HD affective scores from low to high and an 18% increase in HD scores from neutral to low. HD scores of PVG 2 indicated a 40% increase in action tendency scores from low to high. While opposed to the creation of a housing development on Game Lands 176, the general population is not as likely to be vocal (25% had high action tendencies) in their disagreement with this decision as are the users.

Primary differences between the two populations were: (1) the number of individuals with low (or neutral) scores in the general population and high scores in the user population; (2) the high percentage of the general population whose affective scores increased from low to high; and (3) the high percentage of users whose cognitive and action tendency scores increased from low to high.

Use of Motorized Vehicles of Game Lands 176

When the motorized vehicles issue was explored, the data suggested that there were differences between the *E*xisting *C*ondition and the

permitting of *M*otorized *V*ehicle use on this area for both user PVG groups (Tables 1a and 2a). This administrative change would decrease the personal value of this area (Tables 1b and 2b). EC and MV score patterns were similar, except for the difference in direction. There was, however, a 39% increase in MV action tendency scores from low to high in PVG 1. MV score patterns of PVG 2 were very similar to the EC scores. Sixty percent of the users had high action tendencies toward the use of motorized vehicles on the Game Lands, indicating that they would actively oppose the use of motorized vehicles.

From an analysis of the general population, the results indicated differences between EC and MV index scores for both PVG groups (Tables 3a and 4a). Use of motorized vehicles would decrease the value of this land (Tables 3b and 4b). EC and MV score patterns were similar, except for the difference in direction. There was, however, in PVG 1 a 35% increase in MV affective scores from low to high and a 29% increase in low or neutral MV scores to higher component scores. In PVG 2 there was a 40 percent increase in MV action tendency scores from low to high. Only 20 percent of the general population had high action tendencies toward opposing the motorized vehicle issue, indicating that there would not be as much active opposition from this group as from the user population.

The primary differences between the two populations were: (1) the large number of individuals with low (or neutral) scores in the general population and high scores in the user population; and (2) the high percentage of the general population whose affective scores increased from low to high and (3) the high percentage of users whose action tendencies scores increased from low to high.

IMPLICATIONS

Preliminary interviews indicated that the housing development and motorized vehicle issues would produce a diversity of opinion, but results indicated that neither of the suggested administrative changes would increase the value of this land to the user or general populations. The homogeneity of the results does not lend itself to the illustration of utilization methodology. However, the results are suggestive.

To obtain maximum support from the local population, the Game Commission should adopt a policy of no change with regard to these two issues. If this policy is adopted, regional management programs to implement this policy should be oriented toward the coordination of opinions and actions against those who want to change the Game

Lands into a housing development or permit motorized vehicle use on the area. At the field management level, the primary function would be the organization of a cooperative effort of both the user and general populations.

If the Game Commission adopts a policy of change with regard to the housing development or motorized vehicle issues on Game Lands 176 they would meet stiff opposition, backed by support from the general population. The results suggested possible approaches regarding how to change the opinions of these individuals. Most of the opposition would come from individuals who have high action tendencies. Since there is so much similarity in both populations on the two issues, there are only four basic educational programs that are needed to help change the opinions of those with high tendencies. PVG 1 of the users was on both issues oriented toward a cognitive-action tendency dimension. This suggests an approach that relates facts to direct experience. PVG 2 of the users was on both issues related to a dimension that involved all three elements. The approach with these types of individuals must include all three of the value dimensions and expand outward interrelating the three elements. PVG 1 of the general population was on both issues related to all three components suggesting a program similar to that of PVG 2 of the user population. PVG 1 of the general population was on both issues orientated toward two different dimensions. One dimension was related to an affective-action tendency continuum. This would imply an approach that relates the aesthetic qualities of forested land to direct experience. The other dimension was associated with a cognitive-affective element. With these types of individuals, facts should be associated with the aesthetic qualities of forested land. These approaches are only suggestive. Only intergroup differences were used to develop educational approaches. If both inter and intra group differences were used, a more comprehensive approach could be developed. An experimental program should be carried out now to determine ways to implement each of these approaches suggested. If the Game Commission is going to advocate a policy of change, they should give reasons for their decisions. The decision must have been economic, political, and/or scientific because the opinions did not indicate a change, so the evidence offered for accountability must be extremely strong. Before the decision is implemented, there should be educational programs instituted to change the opinions of these individuals who oppose the issues, especially those who have high action tendencies. The primary function of the regional management would be to coordinate the efforts and select a program that would implement the strategies selected by the Game Commission. Because there is so little informa-

tion with regard to educational programs designed for specific audiences, the coordination function at this point in time might involve the experimental testing of several programs designed around particular approaches to achieve change. The primary purpose at the field level would be the implementation of the program selected at the regional management level. The problem at this level would be selection of a program that could reach specific audiences. The primary function, then, at this level would be to isolate points of contact for the specific audience type and institute educational programs to change the opinion of these individuals.

Basic to the success of any policy is the consistency of action among the Commission, regional management, and field personnel. The most important implication from the results is the illustration of the prognosis ability of the utilization methodology. With such utilization methodology, it is possible to associate an increase or decrease in personal value of land with a specific administrative change to a particular population.

The question immediately raised is "How important is the user and general populations opinions in the formation of policy?" Agencies cannot always respond to the will of the people. There may be sound political, economic, and/or scientific reasons for a decision that overrides opinions. Prognosis in this case, plays an even more important role because it permits the identification of target audiences that will be opposed to the decision.

The utilization methodology offered provides a means of prognosis that can increase administrative efficiency and effectiveness through the increasing of understanding about the personal values of the user and general populations.

LITERATURE CITED

Alkin, M. C.
1972. Accountability defined, UCLA evaluation comment 3(3):1-5.

Bloom, B. S. (ed.), M. D. Englehart, E. U. Zurst, W. H. Hill, and D. R. Krathwohl.
1956. Taxonomy of educational objectives: handbook 1: cognitive domain. David McKay, Inc., New York.

Brown, D. G.
1970. A scheme for measuring the output of higher education, In B. Lawrence, G. Weathersby, and V. Patterson outputs of higher education: their identification, measurement, and evaluation. Western Interstate Commission for Higher Education, Boulder, Colorado.

Cesario, R. J., S. E. Goldstone, and J. L. Knetsch.
1969. Final report on outdoor recreation demands and values to middle atlantic utility group. Battelle Memorial Institute, Columbus, Ohio.

Groves, D. L.
1973. A method of utilizing personal value information for increasing administrative efficiency and effectiveness in managing public forested lands—a case study of State Game Lands 176 in Pennsylvania. Unpublished Doctoral Dissertation, The Pennsylvania State University, University Park, Pennsylvania.

Harvey, O. J.
1970. Belief systems and education: some implications for change. In J. Crawford (ed.) The affective domain. Communications Service Corporation, Washington, D.C.

James, G. A. and R. Henley.
1968. Sampling procedures for estimating mass and dispersed types of recreation use on large areas. U.S. Forest Service Research Paper SE-31. Southeastern Forest Experiment Station, Asheville, North Carolina.
Johnson, R. M.
1969. Techniques of market segmentation: cluster analysis vs. Q analysis. Paper read at the 1969 International Marketing Congress, June, 1969, Atlanta, Georgia.
Krathwohl, D., B. S. Bloom, and B. B. Masia.
1964. Taxonomy of educational objectives, handbook II: affective domain. David McKay Company, Inc., New York.
Sonnenfeld, J.
1966. Variable values in space and landscape, Journal of Social Issues. 22(4):71-82.

APPENDIX

Model 1

The following is a condensed description of Bloom's and Krathwohl's typologies. There was a 13 point negative, neutral, and positive scale used to classify an individual's responses.

Cognitive Domain			Affective Domain			Action Tendencies		
-1.	(+13)	Evaluation - An ability to evaluate worth in terms of established criteria	-1.	(+13)	Value complex - Sufficient commitment to an object to build a philosophy of life upon commitment	-1.	(+13)	Consistent behavior, active - Actions which are frequent (once a week or greater) and extensive (over 26 miles)
2.	(12)	Synthesis - An ability to put together elements and relationships in such a way as to clarify structure and process	2.	(12)	Organization - Sufficient commitment to an object to seek to convert others to the cause	2.	(12)	Consistent behavior, passive - Actions which are frequent and limited (26 miles or less)
3.	(11)	Analysis - An ability to break down elements and relationships in such a way as to clarify structure and process	3.	(11)	Valuing - Sufficient commitment to an object to identify with it	3.	(11)	Occasional action, active- Actions which are infrequent (less than once a week) and extensive
4.	(10)	Application - An ability to utilize abstractions in a new situation without being prompted	4.	(10)	Responding - Seeks out object and gains satisfaction from working with it	4.	(10)	Occasional action, passive - Actions which are infrequent and limited
5.	(9)	Comprehension - An ability to use ideas or materials without seeing their fullest implications	5.	(9)	Selected attention - Attends to object inspite of competing stimuli, when the circumstances are favorable	5.	(9)	Low tolerance level - Limited amount of stimulation needed for action; intends to use resource some day
6.	(8)	Knowledge - recall or recognition of material, ideas, or phenomenon	6.	(8)	Receiving - Tolerates the presence of an object	6.	(8)	High tolerance level - Crisis needed to stimulate action; no intention of using resource, but is willing to give up resource to know that the area,feature, or good will exist in a particular condition
7.	Neutral		7.	Neutral		7.	Neutral	

PRIVATE LANDS AVAILABLE FOR WILDLIFE IN CENTRAL NEW YORK

BRUCE T. WILKINS
Assistant Professor of Natural Resources, Department of Natural Resources, Cornell University, Ithaca, New York; and

EUGENE C. ERICKSON
Associate Professor of Rural Sociology, Department of Rural Sociology, Cornell University, Ithaca, New York

Access to private lands for hunting or observing wildlife is largely dependent upon the goodwill and attitudes of private landowners. These attitudes we believe are changing and if true, this will have important implications to many Americans interested in wildlife.

Mammals and birds have been of substantial interest to most Americans throughout our history. Historically, interest in wildlife was focused on their use for food, for clothing, or for decorative materials. More recently recreational uses have been preeminent and this too has altered with time, hunting having been the dominant recreational use, while observation or other nonconsumptive uses have become increasingly common (Hendee 1969).

Ownership of, and access to, these animals thus has been of concern throughout our history. While some recent debate has focused upon who owns non-migratory game species (most argue that the states have legitimate claims to these resources), there is general accord that those owning title to land also possess the right to determine who can seek wildlife on that land. Large uninhabited areas owned by state or federal governments have generally been available for hunting or observing wildlife (lands under the Department of Defense offer notable exceptions). But for most of the contiguous United States access to wildlife is controlled by private landowners.

More than 75 percent of the hunters in the United States spent most of their hunting time on private lands in 1970 (Fish and Wildlife Service 1972). A minor part of this hunting is accompanied by payment of an access fee to the landowner, although hunting in Texas and certain highly specialized forms of waterfowl hunting often do not fit that pattern. For most, however, hunting is dependent upon the goodwill and sufferance of private landowners.

There is concern that landowners have been less and less inclined to have others use their land when seeking wildlife. Numerous studies have shown substantial segments of private lands are posted; *i.e.*, closed to hunting or other trespassing. Some of these studies have sought to relate posting behavior to attitudes of landowners (Waldbauer 1965; McIntosh 1967; Environmental Services 1971).

Two studies underway at Cornell University are providing further insight into trends in posting and characteristics of those who do and do not post their lands. One study basically duplicates procedures used a decade ago by Waldbauer (op. cit.). Conservation officers and wildlife biologists of the New York State Department of Environmental Conservation have determined levels of posting in four randomly selected townships in each of seven regions included in that earlier study. Roads were driven and the proportion of road frontage posted was determined by observation of posted signs.

Preliminary analysis of the data from the road survey indicates increases in posting since 1963 have not been uniform. The general pattern was for increased posting. Some areas apparently had less land posted in 1972 than in 1963 (Table 1). Preliminary analysis indicates much or all of this decrease is an artifact, a new housing development on previously posted lands results in no new land available for hunting, but there may well be a decline in the proportion of road frontage posted.

TABLE 1. PROPORTION OF ROAD MILEAGE POSTED IN 1972 AND 1963 FOR 28 NEW YORK TOWNS

Town	Percent Posted 1963	Percent Posted 1972	Increase or (Decrease) in Percent Posted
Minisink	48	53	5
Neversink	36	69	33
East Fishkill	63	53	(10)
Patterson	71	50	(21)
Region 3 Total	52	58	6
Andes	7	72	65
Richmondville	11	26	15
Durham	18	42	24
Hoosick	6	1	(5)
Region 4 Total	11	39	28
Stratford-S	8	20	12
Thurman-S	2	6	4
Clinton-N	1	12	11
Essex-N	2	9	7
Region 5 Total	4	11	7
Antwerp	1	18	17
Stark	1	2	1
Louisville	1	28	27
Ava	9	13	4
Region 6 Total	4	16	12
Nichols	14	14	0
West Monroe	22	20	(2)
Nanticoke	9	18	9
Venice	2	41	39
Region 7 Total	11	25	14
Macedon	32	6	(26)
Murray	26	26	0
Lima	21	13	(9)
Hornellsville	17	57	40
Region 8 Total	25	25	—
Harmony	11	16	5
Rushford	7	20	13
Marilla	33	21	(12)
Pike	11	16	5
Region 9 Total	14	18	4
Total, 28 Towns	16	29	13

To examine landowner attitudes toward the public's use of their land for recreation, 1,761 questionnaires were mailed to a 25 percent sample of those owning 10 acres or more in the 28 surveyed townships. Three sets of reminders were mailed to non-respondents. Seventy-five percent of the delivered questionnaires have been returned.

The responses from landowners on attitudes toward use of their land for hunting, and certain other uses such as snowmobiling, are now being analyzed. These will give us greater understanding of why landowners posted their lands in 1972. This study built on earlier research dealing with landowners with ten or more rural areas of non-cropland in three central New York counties.

That study has been more fully detailed elsewhere (Wilkins and Erickson 1971) but certain of its findings may be of particular interest to this group.

The study focused on three central New York counties. Broome County is very urbanized, with an urban population of over 150,000. Yates County is quite rural, its population being only 19,000 and 16 percent of its employment is in agriculture. Tompkins County is midway between the other two in size and degree of urbanization.

We located all the noncropland in these counties, took a five percent sample of that land, and questioned all those owning ten or more acres in that five percent sample. For the survey minded, we'll note that we had an 89 percent response rate from a total of 491 owners. An initial reaction may be "that's been done dozens of times"—not so. Many studies have dealt with forest landowners, few have included those not farming and not owning forests and these may be substantial in number, and percentage (ranging from 18 to 25 percent of our county samples).

The data indicate non-farmers, many of whom have urban residences and urban outlook, are becoming an increasing proportion of rural landowners. These people have very different concerns, and seek very different things from land ownership, than did the traditional farmer owner. While economic reasons do still predominate, this is changing (Table 2). Economic returns are not the major interest of those now acquiring this land; recent owners usually hold land for other purposes—for recreation, for privacy and isolation, and to enjoy wildlife and other natural forms of life. Indeed, if the on-site residents no longer farming but citing farming as their original reason for acquiring the land are dropped from the "economic reason" group, over 80 percent of such landowners do not continue to hold these lands for economic purposes.

These landowners appear more interested in wildlife than those

owning land for economic reasons. Many have sought to identify birds by purchasing books (51 versus 38 percent), have planted shrubs for wild animals (21 versus 7 percent) and crops for wildlife (19 versus 12 percent). By their actions and verbal statements these new owners indicate their interest in stimulating and enhancing wildlife on their property for both aesthetics and harvesting.

This puts the hunter or those desiring to observe wildlife in direct conflict with many of these newer landowners for both are seeking the same product from the land. It is only logical to expect those owning the land to act to reduce or eliminate this competition; posting does just that.

And it appears these owners act logically. If one analyzes our data on levels of posting by two groups of landowners, the non-farmers with economic interests were significantly (0.95) less likely to post their land (45 percent posted) than were the non-farming resident who acquired the land for non-economic purposes, and farmers (52 percent posted).

The shift to noneconomic interests by many landowners, combined with other factors currently being analyzed, will lead to a higher proportion of rural lands being closed, closed to hunters and, presumably closed to others wishing to simply observe wildlife.

TABLE 2. MAIN REASON FOR BUYING-KEEPING PROPERTY, BY NON-FARM RESIDENCY GROUP, THREE NEW YORK COUNTIES, 1970

Residency Group	Economic	Isolation	Environment	Recreation	Historical	Other	Totals	N
				Percentage				
BROOME COUNTY								
On-Site	53	30	12	1	2	2	100	142
Neighborhood	67	7	4	15	7	0	100	27
City/Absentee	55	8	25	7	5	0	100	75
Institutions	50	0	30	20	0	0	100	20
Non-Farm Totals	54	19	16	6	4	1	100	264
TOMPKINS COUNTY								
On-Site	35	30	24	2	9	0	100	46
Neighborhood	54	0	23	8	0	15	100	13
City/Absentee	50	13	37	0	0	0	100	8
Institutions	18	0	64	18	0	0	100	11
Non-Farm Totals	37	19	31	5	5	3	100	78
YATES COUNTY								
On-Site	55	20	0	20	5	0	100	20
Neighborhood	72	0	0	14	14	0	100	7
City/Absentee	50	8	17	17	8	0	100	12
Institutions	60	0	40	0	0	0	100	5
Non-Farm Totals	57	11	9	16	7	0	100	44
TOTALS								
On-Site	48	29	13	3	4	2	100	208
Neighborhood	64	4	8	13	6	5	100	47
City/Absentee	54	8	25	7	6	0	100	95
Institutions	42	0	42	16	0	0	100	35
Non-Farm Totals	51	18	18	7	4	2	100	386

This pattern will have significant impact on the future of hunting in affected areas. Where are these "affected" areas? To us it appears most of the states fit this pattern, the exceptions being states with major federal land holdings and those states where economic returns (predominantly farming, timber or pulp production, and ranching) are still major reasons for land ownership.

The future access to land for observing or harvesting wildlife will likely differ in areas where governmental units own the majority of land; where income is the major reason for land ownership; and in other rural areas. Where governmental and income interests dominate, fees are a possible (probable?) solution to gaining access to land in order to "use" the wildlife upon them. Recommendation 81 for a fee for all recreational uses of federal lands (Public Land Law Review Commission, 1970) provides some recent thinking on this matter.

In other rural areas solutions to posting are less obvious. Income has not been an attractive stimulant to these owners; increased protection and services from state game agencies has either gained limited response or had limited availability. Indeed it seems difficult to imagine a mechanism that would stimulate landowners to sacrifice the major reasons they have for acquiring and holding their land. Wildlife and privacy are of major concern to many owners, and isn't keeping all others out the simplest way to retain privacy?

We see a major need to identifying options of interest to the landowners to whom wildlife and privacy are *not* prime objectives.

With clearer understandings of the reasons landowners hold their land, we should be better able to plan strategies to accommodate the needs and interests of those seeking wildlife on private lands owned by others. We view this as imperative if, in many states, those not able to make the substantial investment required for land ownership are to have access to wildlife in the future.

This is not solely a biological question, yet it requires understanding of biology. We see it as a question combining biology, human attitudes and desires, governmental policy, and law. We need to develop the important findings essential if most Americans (the non-land owning person living in a private-land dominated state) are to have private lands available for hunting, or closely observing, wildlife.

LITERATURE CITED

Environmental Services.
1971. Land posting in New Hampshire. N. H. Fish and Game Dept. 71 pp.

Hendee, John C.
1969. Appreciative versus consumptive uses of wildlife refuges: Studies of who gets what and trends in use. *In* Trans. of the 34th N. Amer. Wild. and Natur. Resources Conf. pp. 265-279.

Public Land Law Review Commission.
1970. One third of the nation's land, U. S. Govt. Printing Office. 342 pp.
Fish and Wildlife Service.
1972. National survey of fishing and hunting—1970. Resource Pub. 95, 108 pp.
McIntosh, Kenneth D.
1967. Posting of land in West Virginia and landowner attitudes regarding posting, hunting fees and the hunter. Expt. Sta. Bull. 542. 40 pp.
Waldbauer, Eugene C.
1965. A study of posting on private lands in New York State. Coop. Wildl. Res. Unit, Ithaca. 267 pp.
Wilkins, Bruce T. and Eugene C. Erickson.
1971. Rural non-farmed lands and their owners: A study of three central New York counties. Center for Urban Development Research, Cornell University, Ithaca, N.Y. 143 pp.

ELK BEHAVIOR IN RELATION TO CATTLE GRAZING, FOREST RECREATION, AND TRAFFIC[1]

A. LORIN WARD
Rocky Mountain Forest and Range Experiment Station, Laramie, Wyoming;

JERRY J. CUPAL
Department of Electrical Engineering, University of Wyoming, Laramie

ALFRED L. LEA
Rocky Mountain Forest and Range Experiment Station, Laramie, Wyoming

CHARLES A. OAKLEY
Department of Plant Science, University of Wyoming, Laramie;[2] *and*

RICHARD W. WEEKS
Department of Electrical Engineering, University of Wyoming, Laramie, Wyoming

National forests are being more intensively managed for multiple use. The Pole Mountain area on the Medicine Bow National Forest, Wyoming presented a good opportunity to study elk behavior in relation to cattle grazing, recreation and traffic. Land managers must know the effects of human behavior on wildlife species in order to make proper plans for the use of the land without losing the wildlife resource. Such studies are implicit in the preparation of appropriate environmental impact statements. This study started on April 28, 1971 and concluded on October 8, 1971.

STUDY AREA

The study area encompasses 88 sections and lies approximately 10 miles southeast of Laramie, Wyoming. The topography is mostly rolling ridges with scattered rock outcrops and occasional patches of dense timber. The relief is alternating valleys and ridges, with the

[1] We gratefully acknowledge the generous support of the Wyoming Game and Fish Commission and the Medicine Bow National Forest.
[2] Present address: Wyoming Game and Fish Department, Rawlins.

majority of the small streams flowing west to east. The elevation varies from 9,055 feet on the western ridge to 7,500 feet at North Crow Reservoir on the eastern boundary. Vegetation can be classified into four categories: coniferous forest, shortgrass prairie, mixed shrub, and meadow bottoms; major drainages have running water.

ELK (History, Numbers, Population)

Elk evidently had disappeared from the Pole Mountain vicinity near Laramie before the turn of the century (Murie 1951) although elk were again seen yearlong on the area in 1958. In February 1968, elk from Yellowstone National Park were released approximately 65 air line miles north of Pole Mountain. Four cows and one bull wearing blue neckbands from this transplant have been seen on the Pole Mountain District. The herd is now estimated at 150 animals. Elk have been hunted on Pole Mountain since 1969 under special either-sex permits.

GRAZING HISTORY

According to Forest Service records, Pole Mountain was severely overgrazed by cattle in the 1880's. Cattle stocking rates and grazing seasons fluctuated greatly. Cross fences were constructed and a rotation pasture system started in 1958. Presently there are five grazing allotments with from one to four pastures in each. In 1971 the grazing season was from June 10 to October 16. There were 2,088 cows with calves for a total of 8,334 AUM's.

RECREATION

The Forest Service maintains five picnic grounds and nine major overnight campgrounds on the District. In addition, the Wyoming Highway Department maintains an overnight campground and picnic area near the summit of Interstate Highway, I-80. There were 320,963 visitations by people during the May 12 to October 1, 1970 period and 336,348 in 1971. Picnicking comprises about 35 percent of the visitations, followed by camping with 28 percent.

("Visitation" may be defined as one person entering and leaving the Pole Mountain District. He may stay several days camping or only a few minutes. This activity does not include people traveling on I-80. "Units" means vehicles. These range from two-wheel motorcycles to large diesel semi-trailer trucks.)

Interstate 80, passing through the south end of the study area, is the most heavily used highway in Wyoming. During 1971, traffic averaged 8,600 units per day in July and August.

Graded dirt roads on the District, capable of handling passenger cars, trailers, and light trucks, lead to recreation facilities, pastures

and fishing streams. They are used extensively during the summer. A 6-mile stretch of one of the major roads going east across the District was being improved. Activity included earth movers, graders, water trucks, fence building and some blasting. It carried over 13,000 vehicles during the summer in spite of this construction activity.

There are eight improved campgrounds, one ski area, several picnic, and unimproved camping areas on the District where the telemetered elk and their associates spent the summer. The close proximity of this area to I-80 provides easy access for many people, both local residents and vacationers. The rest and campground area at the summit behind the Lincoln Monument has a great deal of activity, both day and night, during the summer. Recreation visits in the area where the telemetered elk and their associates spent the summer are summarized below:

Type of recreation	*Visitor days*
Viewing	58,100
Picnicking	48,700
Camping, auto, trailer, tent, other	24,200
Fishing	200
Hunting	300
Total	131,500

METHODS

Information on elk distribution and activity was obtained using telemetry tracking and visual observation with binoculars or spotting scopes. Most of the data were taken early in the morning or late evening during elk feeding activities. The elk were never purposely disturbed and the study was never announced to keep from drawing attention of the public.

The telemetry system was developed for use on wild elk (Weeks *et al.* 1972a and 1972b). Radio collars were installed in late April on two cow elk immobilized with 6 milligrams of M-99 (oripavine derivative) from a Cap-chur gun. At the high frequencies used (172 megahertz), the transmission was almost line of sight. The broken terrain limited the range of the system to about 3 miles.

A total of 89 radio tracking observations were made during 67 days. In addition, one transmitter was monitored continuously during daylight hours during the periods August 3 to 5 and 10 to 13. This same transmitter was continuously monitored during the nights of August 17, 18, 24-26 and September 1-2. After considerable practice listening to signal modulation and watching the elk, it was possible to distinguish feeding, resting or rumination, and walking activity.

Data on vehicular traffic and campground, picnic area, and other recreation activity was recorded by traffic counters and spot checks by Forest Service personnel. I-80 traffic information was collected by the Wyoming Highway Department. Periodic traffic counts were also made by research personnel when elk were within one-half mile of I-80.

A 35-millimeter camera with 200-millimeter telephoto lens was used to record and document elk-cattle, elk-recreation, and elk-traffic relations.

A General Radio, Model No. 1551-C, decibel meter was placed at ground level at 10 known feeding sites near I-80 to record traffic noise. Readings were recorded on the A scale and classified as to trucks and cars.

RESULTS AND DISCUSSION

During the study period we identified 31 bulls, 66 cows, and 38 calves in the herd. Wide elk distribution and heavy tree cover made summer counts difficult.

The data from the two telemetered elk indicated spring movement of the elk was mainly influenced by availability of new, succulent forage. During May elk were dispersed over the whole district with no indication that they had well-defined migration routes (Fig. 1).

Once the cow-calf groups were established in July, their movements were localized in an area of about 2 to 3 square miles. Cow 4 traveled a much larger course which extended over 132 square miles. The range of Cow 4 extended over about 20 square miles while she was in a harem during the breeding season. Cow 5 ranged over a total area of 26 square miles.

Cow 5, about 2 years old when captured, did not have a calf. She was always seen in a group with from 3 to 25 other elk (17 adults and 8 calves). A total of 32 elk (4 bulls, 2 spikes, 18 cows, 8 calves) were seen within the 3-square-mile area southeast of Lincoln Monument where Cow 5 spent most of the summer and fall.

Cow 4 was first seen with six other elk. She had a calf about the first of June and was always seen thereafter with at least seven other elk. The largest group she was with was a harem of 16 elk on September 10.

Cow 4 was not located from June 16 until August 8, when she was found 1 mile southeast of Lincoln Monument, near I-80. She had escaped detection because we reasoned that she would not move into an area that was so heavily used by recreationists.

The two telemetered elk were never in the same group of elk, although they were within 1 mile of each other on several occasions and were located at different times in the same area.

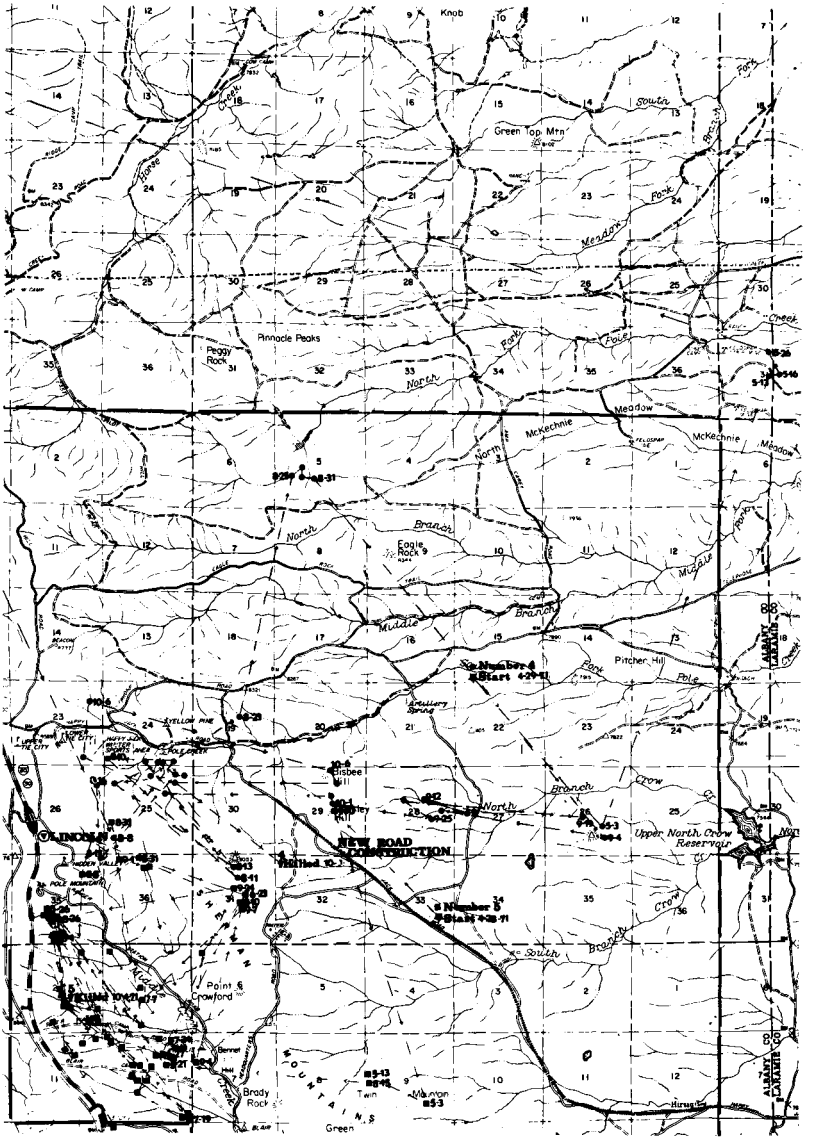


Figure 1.—Telemetered cow elk travels April 28 to October 8, 1971.

From fixes or sightings of telemetered and unmarked elk, habitat use was as follows:

Time of day	*Number of observations*	*Timber*	*Prairie*	*Meadow*
			Percent	
5:30 a.m. to 9:00 a.m.	80	71.00	25.00	4.00
9:00 a.m. to 5:30 p.m.	38	84.00	13.00	3.00
5:30 p.m. to 8:30 p.m.	72	60.00	22.00	18.00
8:30 p.m. to 5:30 a.m.	7	72.00	14.00	14.00
Averages (percent)		71.75	18:50	9.75

The low exposure during midday would account for the lack of reports of elk observations by recreationists.

Cow 5 was continuously monitored from 6 a.m. to 9 p.m., for seven days in early August, four nights in late August and on September 1 from 9 p.m. to 7 a.m. Her daylight movements for August 3, 4, and 5, 1971 are shown in Figure 2. Night movements for the period August 24, 25, and 26, 1971 are shown in Figure 3.

During daylight she was seen eight times on open ridges. Three sightings occurred before 7 a.m.; the other five were after 8 p.m. On three occasions Cow 5 and her associates were seen feeding within a half mile of I-80. Once they were seen feeding on an open ridge within 300 yards of I-80.

Cow 5 moved about 3 miles between 11 p.m. and 6 a.m. on August 17-18, which was a very dark night. She traveled within a half mile of the large occupied rest area at Lincoln Monument on I-80. She was seen one evening and early one morning with four cows and two calves within 400 yards of I-80.

Elk-Livestock Responses

Elk and cattle appeared to be socially compatible. Their grazing patterns were similar during the study period. Both grazed early and late in the day although elk often started earlier and were observed feeding on the ridges later in the evening. They also showed a similar preference for grazing areas.

Cow 5 was often observed near black Angus cattle (571 cow-calf units), which were in a large pasture from June 10 to October 15, 1971. Grazing is moderate and the pasture is in good vegetative condition. Four times, cattle and elk were seen feeding within 25 yards of each other. In 14 instances, involving 46 elk, they were seen less than 100 yards from each other. On one occasion, a cow and five elk (three cows and two calves) were seen on the same salt lick. On

another with five cows and one 6-point bull, Cow 5 was seen feeding within 50 feet of cattle less than 1 mile from the heavily populated rest area.

Cow 4 spent most of the summer in a pasture which is used by

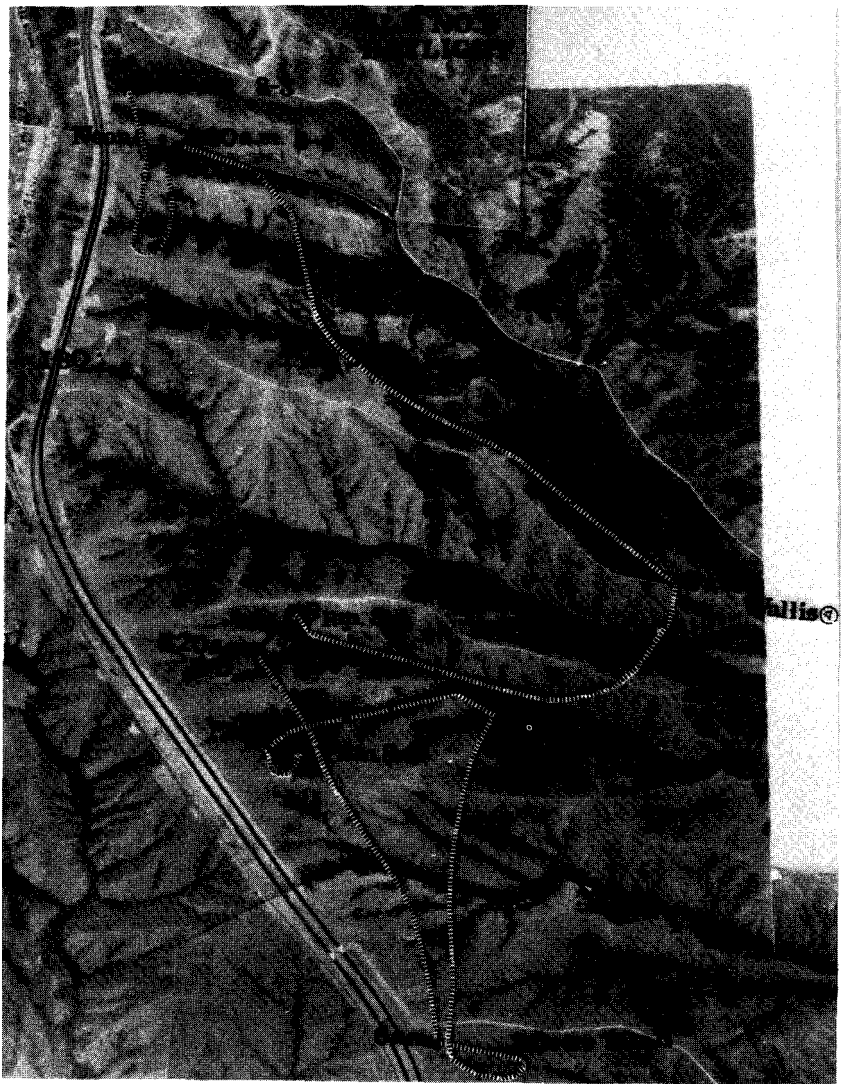


Figure 2.—Daylight movements of cow elk 5 on August 3, 4, and 5, 1971.

cattle early and late in the season. The cow and her associates were never observed closer than one-fourth mile from cattle. She was in pastures with cattle only twice for over 4 days. She did, however, cross through pastures containing cattle several times.

Figure 3.—Night movements of cow elk 5 on August 24, 25, and 26, 1971.

The standard four-strand barbed wire fences between pastures had little influence on elk movement. Calves less than 2 months of age merely crawled under the bottom wire. As the calves became older they showed apprehension about going through fences. On occasion, some calves would go through after the cow had jumped over, while other calves remained on the opposite side of the fence. From late July until mid-September it was quite common to see elk move down a fence looking for a low spot or broken wire.

Response to Motor Vehicles and Recreation

Motor vehicle traffic through the counter at the Lincoln Monument access road registered 224,308 vehicle crossings from May 12 to October 1, 1971. Fifteen counts of I-80 traffic, taken by researchers when elk were located within one-half mile, showed the average rate was about 190 per hour. Trucks averaged about 30 per hour.

Elk location data were tabulated in relation to the combined motoring on I-80 and the dirt roads on the District. On 14 occasions involving 48 elk (30 cows, 12 calves, 6 bulls), animals were observed within 300 yards of vehicles. There were 21 times when elk were 300 yards to one-fourth mile and 17 times when they were one-fourth to one-half mile from traffic. They were located one-half to 1 mile from traffic 55 times. The times located over 1 mile from traffic dropped to 27 because of the proximity of roads. We did not consider the secondary roads on many ridges that were also used periodically by recreationists and cattle operators.

Noise level readings were taken at known elk feeding sites within 1 mile of I-80. The sound meter was laid on the ground at each location and at least five readings on the "A" scale were recorded for cars and trucks. Noise readings on the ridge tops near the fence along the highway were 54 to 62 decibels for cars and 58 to 70 decibels for trucks. The wide variation was due mainly to traffic in the uphill lanes being closer to the meter. Constant readings were difficult to obtain due to the wind. The figures represent the most constant levels taken at night when the wind was less than 10 miles per hour. The elk did not spend much time feeding in areas where noise levels were highest, but they did not show any adverse reactions to the noise when feeding.

Both telemetered elk appeared cautious about crossing major roads. Cow 5 did not cross I-80. She and two cows and a calf crossed a well traveled secondary road one morning within 300 yards of I-80, but returned within a half hour. Cow 4 crossed another secondary road six times from August 8 to October 8. Four of these crossings occurred during the hunting season; three may have been caused by hunters.

One of the four large bulls associated with Cow 5 tried to cross I-80 and was hit and killed by a camper-truck on the night of June 28. This was the only known case when elk tried to cross I-80, although two cows and one calf were seen southwest of the highway during the summer.

On only two observed instances during the summer was it obvious that people in moving vehicles had seen elk, once on I-80 and the other on a secondary road. When the vehicles stopped, the elk quit feeding and watched the vehicle. When people left the vehicle the elk moved into the timber out of sight.

Most of the traffic on the District roads occurred during the middle of the day. The elk during this period were usually in the conifers, which would account for less disturbance to the elk and the very low incidence of elk being seen by people.

The number of times elk were fixed or seen in proximity to people involved in out-of-vehicle activity showed the elk apparently prefer to keep a distance of at least a half mile from these recreationists. Of 401 elk seen in association with the telemetered elk, only 57, or 14.2 percent, were within one-half mile of people involved in out-of-vehicle activities.

Cow 4 was located twice within 300 yards of people camping, picnicking and fishing. She was found only six times out of a total of 39 (15.4 percent) closer than one-half mile to people camping or fishing. On August 19, she and 13 other elk (5 cows, 5 calves, 3 bulls) were found resting in the conifers about 265 paces from the unoccupied Pole Creek campground. Three bulls were seen within one-fourth mile of this same campground on August 23. The area has a good cover of conifers.

Cow 5 was located 12 times out of a total of 104 within one-half mile of people involved in the out-of-vehicle activity of camping, picnicking, or fishing. On several occasions she was within 1 mile of more than one type of recreationist. In each case, the close encounters occurred during the day when the elk were in the timber. The close encounters for Cow 5 occurred in May and June, which may indicate the elk respected activity centers more after once getting them positioned in their range.

MANAGEMENT IMPLICATION AND CONCLUSIONS

Elk are very adaptable. They are compatible with cattle during the summer grazing season on a range where there is an adequate food supply. Open gates in non-used cattle pastures and establishment of pole-jumping stiles at known elk crossings would help prevent fence damage and allow elk to move freely on livestock ranges.

Automobile and truck traffic on I-80 had little effect on elk behavior within 300 yards; however, the I-80 highway does act as a barrier to elk movement. There were very few instances of elk being seen by motorists, even when the elk were on exposed ridges. This study would indicate that logging and recreation roads with moving traffic would have little effect on elk activity once the elk become used to them. The major concern would be to keep roads away from elk feeding sites on open meadows and slopes and along stream courses.

The elk on Pole Mountain preferred about a half-mile distance from people who were camping, picnicking, and fishing. In planning recreation facilities in elk habitat, consideration should be made to keep elk feeding sites about a half-mile distance from people concentration areas and to provide adequate cover buffer zones.

LITERATURE CITED

Murie, Olaus J.
1951. The elk of North America. The Stackpole Co., Harrisburg, Pa. 376 p.

Weeks, R. W., A. L. Ward, and J. J. Cupal.
1972a. A telemetry system for studying elk behavior in the Rocky Mountains. Ninth Annu. Rocky Mt. Bioeng. Symp. [Omaha, Nebr., May] Proc. 1972: 177-181.

Weeks, Richard W., Jerry J. Cupal and A. Lorin Ward.
1972b. Telemetry tracking of summer transplanted elk in south central Wyoming. Int. Telem. Conf. [Los Angeles, Calif., Oct. 1972] Proc. 1972: 238-244.

TECHNICAL SESSION

Wednesday Morning—March 21

Chairman: HAROLD C. JORDAHL, JR.
Professor, University of Wisconsin, Madison

Discussion Leader: ROBERT B. WEEDEN
Professor, University of Alaska, Fairbanks

PLANNING FOR INTENSIVE RESOURCES MANAGEMENT

INTERGOVERNMENTAL LAND PLANNING: ALASKA'S MODEL

VICTOR FISCHER
Institute of Social, Economic and Government Research, University of Alaska, Fairbanks, Alaska

Far-reaching changes are underway nationally and internationally in values and policies relating to land, resources, and environment. Major steps have been taken at the federal level: the National Environmental Policy Act, coastal zone management legislation, environmental pollution laws. We can count on, or at least hope for, major new initiatives in national land use, public land management, and other resources and environment-related policy areas. Underlying most of these developments are new institutional processes and intergovernmental patterns. We see, for example, increasing emphasis on the states, singly or in regional groupings, in new approaches to land and environment. Similarly, most new programs strive to use the planning process to rationalize decision making and achieve program coordination.

It is also clear that no pure or single models for policy or planning have emerged, and experience and reason tell us that we shouldn't expect any. Flexibility and adaptation to changing realities, rather than pursuit of idealized static schemes, have been and will no doubt

continue to be indispensable elements of any strategy for resources management and growth policy. It is in this perspective that I wish to discuss an Alaska effort in intergovernmental land planning.

The Joint Federal-State Land Use Planning Commission for Alaska, established less than a year ago, has a name with the right ring, the right connotation. It brings the Federal and State Governments together into a joint enterprise, it deals with land use on a statewide basis, and it is directed toward critical issues of land, resources, and environment.

It is important to note, however, that the Commission was created as part of the largest land reallocation act in recent U.S. history. With 40 million acres being granted to Alaska natives, 125 million reserved for national purposes, and state selection of 103 million acres reopened, the Commission immediately found itself the focus of intense pressures while subject to incredibly tight deadlines. Under the circumstances, broader and longer-term planning concerns have inevitably been submerged. It is premature, therefore, to present the Alaska Commission as a model or prototype for intergovernmental land planning; it may well be another year before we can judge whether Alaska's example will be one to emulate or reject.

Nevertheless, Alaska is already an important testing ground for joint federal-state planning and decision making. It presents an opportunity to observe and analyze interactions between and among Federal and State Governments and major interest groups, including Alaska natives, developers, conservationists. And the Alaska experience raises, once again, the question of what comprehensive land-use planning is all about and how it can be carried out. In view of the many problems that have existed throughout the United States in defining and carrying out effective planning, the case study of Alaska land-use planning is certainly worth pursuing.

CONCEPTION AND BIRTH

The Joint Land Use Planning Commission emerged as a by-product of the Alaska Native Claims Settlement Act passed by Congress late in 1971. Authorized as a result of last-minute efforts to safeguard national interests in Alaska's lands, the Commission is, in effect, one of the compromises leading to enactment of the Claims Settlement. As a result, there have been continuing uncertainties as to its present and future role.

The Alaska Native Claims Settlement Act

The Alaska Native Claims Settlement Act, which includes the charter for the Joint Commission, was the culmination af a century of

promises by the United States Government. Since the 1867 treaty of purchase with Russia, Congress has repeatedly reserved to itself the right to provide for Alaska natives—Eskimos, Indians, and Aleuts. However, in the absence of felt need or urgency, there was no action to settle aboriginal land issues. Most natives lived in regions far removed from white men's intrusion, and where contact did occur—either in native communities or in the new urban center—it was mostly isolated individuals and families who were affected. Basic processes of culture change were sufficiently slow, invisible, and insidious so as not to give rise to demand for change in the *status quo.*

The major impetus for legislative action came from implementation of the Alaska Statehood Act and arctic oil discovery. The grant of over 100 million acres to the new state led to a number of land selections that infringed upon traditional native subsistence areas. As concern and then protests mounted, natives organized regional associations along ethnic lines, and in 1966, formed the statewide Alaska Federation of Natives to lead the legal and political fight for recognition of their claims to most of Alaska.

The land claims and a resultant freeze on disposition of federal lands by the Secretary of the Interior in late 1966 slowed Alaska's development. The existence and threat of law suits and environmental impact issues blocked construction of the trans-Alaska pipeline. When the state and oil companies realized that the pipeline and further oil development were stymied until a claims solution was reached, the drive for a legislative settlement accelerated rapidly.

Enacted in December of 1971, the Alaska Native Claims Settlement Act granted 40 million acres to native villages and regional corporations. In compensation for lands previously taken and for extinguishment of further claims, the Act provided for payment of $462.5 million from the U.S. Treasury over a period of 11 years and for payment of an additional $500 million derived from a two percent royalty on leasable minerals produced from federal and state lands patented after the date of the Act.

Establishment of the Joint Commission

The motive forces for creation of the Joint Land Use Planning Commission were the fear that Alaska might be despoiled in the dividing of lands among state and native interests and the desire to protect the national public interest. A more specific Congressional concern was overview and adjudication of the many vague and incomplete provisions of the Settlement Act. A particular purpose was to deal with the problems and conflicts expected to emerge from transfer of land to the natives, the State of Alaska, and the four

national systems—national parks, national forests, wildlife refuges, and wild and scenic rivers.[1]

Early claims settlement bills had dealt only with native land and compensation; some of the versions provided for a native commission that would oversee distribution of lands and moneys. It was only upon full realization that the 40 million acres for the natives, together with the statehood grant of 103 million acres, would remove the bulk of prime lands from the public domain that the legislation was expanded to include national and public interest provisions. Thus, amendments were adopted to authorize allocation of 80 million acres to the four national systems and withdrawal of additional land for classification and protection of the national interest. These provisions were included in preference to a continuing freeze on land disposal pending the preparation of a land use plan for Alaska and its approval by the Congress.

As enacted, the legislation provided for almost simultaneous land disposition for native, state, and federal purposes and left many matters open for further action, particularly by the Secretary of the Interior. These included withdrawal of national interest lands, provision for deficiency withdrawals in cases where lands to which native corporations were entitled were not available for their selection, priority of state selections *vs.* federal withdrawals, etc. Congress clearly intended that these issues be within the Joint Commission's purview, even though no specific instructions to this effect are contained in the Settlement Act. Yet, Congress did not grant the Commission any formal arbitration, regulatory, or enforcement powers. The final conference committee report on the Settlement Act stipulated that the Commission would be limited to providing advice, coordination, and making recommendations to the State and Federal Governments.

The intergovernmental character of the Commission was established through its membership. It is headed by two co-chairmen: the

[1]The concept of joint planning for Alaska was not new however. Establishment of a federal-state natural resources and regional planning commission had been recommended by the Public Land Law Review Commission in 1970. Early in 1971, the Alaska Legislature had, upon Governor William Egan's recommendation, enacted a bill to establish the state half of a joint land-use planning commission, the motivation being largely to demonstrate to Congress and to conservationists that Alaskans were as interested as anyone in achieving planned development of its lands.

Earlier efforts toward joint planning should also be noted. In 1962-1963, agreement between federal and state officials led to drafting of concurrent executive orders for state and federal development planning groups, with provisions for joining them together. With President Kennedy's assassination, the federal order was not executed. However, the 1964 Alaska earthquake brought into being the Alaska Reconstruction and Development Planning Commission, and its authorization was based largely on the previously drafted executive order. When this commission finished its work after less than six months, it recommended a continuing federal-state planning process. This led to establishment of the Federal Field Committee for Development Planning in Alaska; however, a state counterpart never materialized. The Federal Field Committee expired in 1971.

federal co-chairman appointed by the President and confirmed by the Senate, and the Governor of Alaska or his designee. Four more federal members serve by appointment of the Secretary of the Interior, and four state members are appointed by the Governor. The Commission was authorized for five years only, expiring in December 1976.

Congress enumerated some specific, but mostly vague and general Commission responsibilities. Only two specific tasks are assigned to the Commission: it must identify public easements across lands selected by Native corporations (primarily to guarantee public use and access) and review existing withdrawals to federal public lands and recommend any modifications to the President.

Several broad grants of authority were also made. First, it was provided that the Joint Commission *"shall"* undertake a process of land-use planning. This process is to cover (1) areas to be retained in federal ownership as parks, game refuges, and other public uses, (2) areas of federal and state lands to be made available for disposal, and (3) uses to be made of lands remaining in federal and state ownership. Essentially, the areas thus included for planning purposes cover virtually all of Alaska. In addition, the Commission was instructed to ensure that economic growth and development is orderly, planned, and compatible with state and national environmental objectives and with the economic and social well-being of the native people and other residents of Alaska. Further, the Commission is also to assist in developing land-use plans for state and native lands, coordinate land use decisions, and advise on land selections. Finally, the Commission is to advise the President, Governor, Congress, and State Legislature on laws, policies, programs, and fiscal matters.

In mid-1972, the Alaska Legislature enacted parallel state legislation for the Joint Commission. The state provided that any recommendation as to use of state lands made by the Commission and concurred in by the Governor or his designee would constitute a legal use classification until the expiration of the Commission in December 1976 and beyond then until changed by state law. Since all decisions of the Commission require the approval of both the federal and state co-chairmen, this provision does not delegate state power to the federal body, but it does open the way to a potential land-classification function for the Joint Commission.

While the basis for a broad-gauge and comprehensive planning process to deal with land, environment, and economic growth in Alaska was thus provided, performance requirements are few and these mostly of minor significance. As a result, the specific course of

the planning program lay in the hands of the Commission itself, shaped of course by the circumstances that created it.

THE FIRST YEAR

The Joint Commission first met on July 31, 1972. Governor Egan, the state co-chairman, reasserted his support of the Commission as the vehicle for coordinated land and environmental planning. Secretary of the Interior Rogers C. B. Morton stressed his intention to rely heavily on the advice of the Commission in reaching the many decisions he would have to make on the lands and resources of Alaska under the Land Claims Settlement Act. He specifically requested the Commission's recommendation as to the 80 million acres to be withdrawn by him under provisions of the Act. The Secretary's withdrawal actions had to be completed by September 19, and he asked for the Commission's advice by August 15—only two weeks away!

The Commission had essentially three basic choices: ask Congress for an extension of the withdrawal deadline, make the recommendations as best it could under the circumstances, or simply demur. The latter course was immediately dismissed, since the Commission did not wish to begin its life by waiving the first decision-making opportunity. An attempt was made to obtain a deferral of the withdrawal deadline, but it quickly became apparent that this was not feasible. Consequently, the Commission proceeded with a crash effort to produce a set of recommendations.

Through a series of thorough briefings by all agencies and parties in interest, the Commission was able to quickly size up the issues and isolate principal areas of problems and conflicts. Since withdrawals by the Secretary of the Interior would set land aside for further study and subsequent determination as to use and agency jurisdiction, conflicts between federal agencies were at this stage not material. Instead, problems related to proposed federal withdrawals of land desired by the state or natives, and to the question of which land would be reserved for the four national systems and which held for further national interest study (land in the latter category remaining opening to mineral prospecting and entry).

The Commission did manage to adopt a series of withdrawal recommendations within two weeks of its initial meeting. These were based in large part on federal agency identification of areas that were obviously fit for further consideration for inclusion in one of the four national systems. It was at the margin that the Commission itself fashioned significant recommendations. In a number of instances, minor adjustments were made to assure availability of suitable land for native selection. In more critical cases, the Commission supported

state agency recommendations for placing some land in national interest rather than the four national systems category and for excluding other lands from withdrawals altogether to make them available for state selection. While these areas were not substantial compared to the 80 million acres withdrawn for the four systems and another 46 million acres reserved for national interest purposes, they included some highly important mineralized and wildlife habitat areas sought by the state. In exchange for the Secretary accepting recommendations of the state and the Commission, the state agreed to rescind a large number of its January 1972 land selection filings that were in conflict with prospective withdrawals, and thereby lifted a legal cloud hanging over substantial land areas.[2]

By acting on a crash basis, the Commission discharged its first specific assignment and demonstrated its ability to act, though with little or no planning or extensive deliberation. Its major achievement was to lessen conflict and satisfy several principal parties in interest. It received much approbation, except from some conservationists who felt that the accommodations to the state had been made at the expense of a number of areas critical to the national interest and from others who wanted all lands kept open to development.

Since then, the Commission has spent a small part of its monthly three-four day meetings reviewing its responsibilities and directions. Based on several staff papers, it has considered general objectives and procedures, but has not yet reached conclusions about its overall goals and methods. Major concern and time have been devoted to (1) working with native corporations and the Interior Department to assure that adequate land would be available for native selection, (2) recommending changes in BLM regulations for implementation of the Native Claims Settlement Act, (3) requesting adequate funds for land and resources agencies, (4) exploring identification of public easements to be included in transfers of land to native corporations, and, above all, (5) developing a comprehensive and extensive data base for future decision making.

A large part of Commission meeting time has been devoted to public hearings, formal and informal. From the first, the Joint Commission committed itself to transacting its business in public and to hearing any expressions of opinion about land use and related issues. The purpose of this policy is to provide a medium for the airing of views not available through most government agencies, in

[2]When Secretary Morton in March 1972 withdrew 220 million acres for potential inclusion in the four national systems and in national interest study areas, 42 million acres of these were in direct conflict with previous state selections. The state then filed suit, contesting the federal withdrawal, asserting that the Alaska Statehood Act of 1958 had priority over the Alaska Native Claims Settlement Act of 1971. In the out-of-court settlement, the state relinquished some 40 million acres to federal withdrawals and to native deficiency areas in return for selection rights in 1.6 million acres of "critical" areas.

this way assuring that no relevant concerns are ignored in planning and decision making.

Meanwhile, the Commission and its staff have been looking at the next of a series of major deadlines under the Alaska Native Claims Settlement Act.

When the Secretary of the Interior made the 80 million acre withdrawal last September, he only delineated the boundaries of areas that would be further considered for inclusion in one of the four national systems. He next must advise Congress—by December 18, 1973—which lands he recommends for inclusion in each of the four systems. The Joint Commission's role is to advise the Secretary and Congress on these four systems decisions. And in order for its recommendations to be considered in fashioning Interior's legislative proposals, the Commission must formulate its suggestions to the Secretary by July.

The Commission is obviously caught in another time crush. Its task will be further complicated by the Secretary's instructions that all plans from the interested federal agencies be submitted only to the Interior Department so as not to create public controversy and dissension. Although major conflicts between agencies will likely be restricted to only a few areas, these will be among the most significant ones, including the Wrangell Mountains region. These are the conditions under which the Land Use Planning Commission is now preparing for the decisions and recommendations it must make over the next few months.

THE DECISION MAKING PROCESS

In making its recommendations to the Secretary of the Interior, the Joint Commission does not intend to specify what land is to be included in each of the four national systems. Instead, the emphasis will be placed on the *use* to which lands should be devoted, regardless of agency jurisdiction. The rationale for this approach is that the important consideration from the Commission's standpoint is the exclusive, dominant, or multiple uses to which a given tract of land is to be devoted. The question of agency jurisdiction then becomes subject to Congressional determination. Thus, it is quite possible to provide for wilderness areas within any one of the major systems; likewise, mining entry could be allowed not only in national forests and wildlife refuges, but also, subject to Congressional actions, in national parks. The emphasis on land uses rather than agency jurisdiction also provides the Commission with greater flexibility in making follow-up management recommendations to the Congress because the Commission will not have made commitments to specific systems and governing agencies.

How the Commission arrives at it recommendations will largely determine the future effectiveness of the Commission and its programs. The Commission certainly has the personnel and fiscal resources for carrying out a well-designed decision-making process. Its federal co-chairman is Jack Horton, recently appointed Assistant Secretary of the Interior for Land and Water Resources. The full-time state co-chairman serving in Governor Egan's absence is Joe Josephson, an experienced state senator. Other state members include the Commissioners of Environmental Conservation and Natural Resources, the executive director of the Alaska Federation of Natives, and an ex-legislator. Appointed federal members include a teacher and writer on environmental issues, the former chairman of the Federal Field Committee for Development Planning in Alaska, the former executive secretary of the Alaska Conservation Society, and the mayor of Anchorage. As its Executive Director, the Commission has a former Bureau of Land Management employee who had worked in Alaska and last served in Washington as Chief of the Division of Lands and Realty. Additionally, the staff includes two lawyers familiar with public policy and land law, a regional planner with many years of Alaska community planning experience, a public relations specialist, and a native liaison staff member; an economist is joining the staff shortly. Under a contract with the Bureau of Land Management, the staff is currently supported by the Resource Planning Team, composed of some 30 specialists from various federal and state agencies. The Commission has a budget of $1.4 million during this year and anticipates receiving a similar amount next fiscal year. Thirty percent of this year's budget is used for the Resource Planning Team.

In preparing for its forthcoming decisions, the Commission and staff have been placing major emphasis on obtaining resources data and conducting extensive hearings inside Alaska and outside the state.

The development of an adequate data base has, as mentioned, been a prime activity under the Commission. The Resource Planning Team has been carrying out a statewide inventory of all land and resources and is proceeding toward an analysis of potential uses in selected areas. (Of recent, ERTS satellite sensing data is being added to the plethora of other sources.) All information is being compiled, mapped, and made available not only to the Commission but also to the federal and state agencies, native groups, and other interests.

The Joint Commission has already sought expressions of opinion from special interest groups that might be affected by decisions on the four national systems. For example, Alaska native groups forcefully

raised the problem of continuing subsistence use of land to be put into reserve status. The Commission then sponsored a special conference on the subject, and future Commission actions on land use and management will undoubtedly take into account native subsistence hunting, fishing, and other uses in remote areas of the state.

The Commission is now preparing a program to disseminate information about the impending land decisions and is scheduling hearings to obtain public views prior to making any further recommendations about land use and management systems. These hearings will serve not only the Commission, but will also be used to meet agency, Interior Department, and, possibly, NEPA environmental impact statement purposes.

The hearings will not focus on any specific proposals, both because agency recommendations for the four national systems will not be available to the Commission and because the Commission has not itself prepared proposals that could provide a basis for discussion. Instead, the Commission, drawing on staff and agency personnel as needed, will provide an overview of the resource values of each area and then ask all interested groups and individuals for their views on future uses of land.

These hearings, together with the data and analyses provided by the staff and Resource Planning Team, are expected to constitute the base upon which the Joint Commission will formulate its use recommendations as to the allocation of the 80 million acres to the four national systems.

I have not mentioned "planning" among Commission activities. To the degree that planning means any process of analysis and deliberation leading to a decision, the Commission can be said to be engaged in planning. If, however, planning is viewed as systematically and explicitly determining goals and objectives and arriving at the means and decisions for achieving them—then the Commission is certainly not in planning.

The absence of a systematic, comprehensive land-use planning program is not necessarily due to any lack of desire for planning. With a few exemptions, the Land Use Planning Commission and its staff have had little exposure to land-use planning. And, while otherwise highly qualified, their preoccupation with immediate problems and pressures has limited their concern for planning possibilities. Under the circumstances, with deadlines constantly looming, it has seemed necessary to them that the Commission concentrate on each task as it comes along. Most Commission members have thus considered the deadlines and pressures facing them as creating an

environment within which systematic, formal, and comprehensive planning could not be accomplished, as desirable as it may be.

The limitations of a non-planning approach have, however, been increasingly recognized by the Joint Commission. Members are realizing the difficulty in relating *ad hoc* decisions to elusive national, state, or individual goals for Alaska. Consequently they are now beginning to seek a planning process that will relate decisions to broader goals and objectives.

The key to understanding how planning can serve the Commission lies in abandoning the view of planning as a long, drawn-out process producing documents for the shelf. Contemporary planning emphasizes planning as a decision-oriented process consisting of a number of interrelated, and frequently overlapping, elements: assessment of problems and needs; identification and continuous refinement of goals and objectives; systematic collection and analysis of pertinent data; design, testing, and evaluation of alternative courses of action (*i.e.*, alternative sets of policies, plans, and strategies); selection of preferred courses of action, taking into account consequences of policy decisions; and follow-up—action programming, allocation of responsibility, coordination and evaluation of program implementation, arranging for continuing planning. Such planning is continuous, it takes full cognizance of planning and decision interrelationships, and it attempts to give concrete effect to long-range goals through current action.

Planning as a rational and systematic approach to defining and implementing goals is directly applicable both to general land use planning for all of Alaska and to specific determination of the use of individual tracts of land. While from the Commission's standpoint the latter is most urgent now, both the immediate and longer-term Commission objectives can be served through a comprehensive planning process. In addition, planning can provide the basis for interaction between the activities of the Commission and other efforts in Alaska, including state, regional, and local planning.

Specifically, planning would force the Commission to delineate national, state, native and nonnative, environmental and developmental, and other values and goals. No matter how incompatible some of these may be, making conflicts and agreements explicit is the first step toward dealing with problem solving decisions. More important, a clear understanding of values and goals—something now lacking—would permit the Commission to achieve the balance of interests it strives for.

Abstract values and goals are, of course, not necessarily enough for guiding specific actions. They do, however, provide the basis for

allocational decisions. For example, it is quite possible to identify and evaluate the wilderness reserves that could be established. Similarly, economic objectives and related analyses can provide the basis for determining whether known or suspected mineral deposits should be made available for development. And in case of clear conflict, decisions can be made openly and with broader public understanding of pertinent implications. Further, the comprehensive planning approach means that local and regional land use decisions will be reached in the context of the larger whole. Whether at the level of an individual township or of the Wrangell Mountains region, decisions would be related to the whole of Alaska. In short, a comprehensive planning process provides the basis for relating specific land use decisions to broader social, economic, and environmental objectives.

Let me provide a very specific example of how planning can serve the Commission.

I have referred to the Commission's concentration on developing a complete resources data base. Under pressures facing the Commission, massive data collection can readily become a substitute, rather than a support, for planned decision making. The obvious risk is that the unguided quest for more and more data results in an extensive accumulation that may be irrelevant to future decisions. Thus, while the resources inventory is producing material that can be useful to many for different purposes, it may have no more significance to the major land planning and management decisions to be made in the foreseeable future in Alaska than did the massive regional data systems projects fashionable elsewhere in the 1960's. Thus, it is likely that when the Commission comes to the point of decision, the information and analyses that it really requires will not be available, though mounds of data may exist. By defining in advance problems, objectives, and potential alternatives, the planning process can identify the information and analyses directly pertinent to the decisions to be made.

Yet, it may be just this systematic and explicit approach to decision making that stimulates resistance to comprehensive planning. Lacking agreement on goals, objectives, policies, and standards, each decision can be reached individually, on the basis of whatever arguments and power can be brought to bear. Keeping specific purposes and maneuvers under cover until the point of decision making, and even thereafter, obviously permits expedient attainment of special purpose interests.

In this light, let us look at possible outcomes. In the event that the Joint Commission continues its *ad hoc* or quasi-planning style, the most likely losers will be the State of Alaska and Alaska natives. This

is because the final decisions with respect to land use and management systems will be made by the U.S. Congress. In this arena, it is national rather than state or native interests that will have the best access and greatest influence. Complaints from Alaska groups will not be very sympathetically heard, since the state has already received the rights to over 100 million acres of Alaska, while the natives will receive 40 million acres plus close to $1 billion in compensation. An effective planning process is therefore of greatest benefit to these two parties. (This is not to deny that there are federal and other non-Alaska interests concerned with achieving an appropriate balance in the development of Alaska.)

In view of this general situation, the Commission's policies are likely to be frustrated without a well-organized land-use planning process: it will have increasing difficulty making discrete decisions about land use and agency jurisdictions, choosing between state and federal ownership, maintaining mineralized areas in open or closed status, and accomplishing other ends that will maximize long-term public benefits from Alaska's lands both to Alaska and to the United States.

CONCLUSION

At the opening session of the Joint Federal-State Land Use Planning Commission, Governor Egan stated that the definition of goals was the major challenge facing the Commission. The Commission has not so far clearly defined its functions or established a program of planning for land use in Alaska; rather, it has engaged mainly in piecemeal decision making. It has not concerned itself with *all* land in Alaska, as emphasized in the Governor's opening remarks.

Though short on planning, the Commission has functioned well as a joint federal-state body, representing possibly the best working relationship existing anywhere on a statewide basis. This type of joint undertaking is particularly important in Alaska, where federal control over land and the national interest in development are substantial, while state and federal interests in Alaska, its environment and resources, sometimes diverge sharply. Although major conflicts have not yet been faced, the Commission has provided a forum for interaction between differing views and for achieving policy concensus. Federal and state officials have so far avoided any serious confrontations, working out accommodations rather than pursuing disagreements.

We can conclude that while the Joint Federal-State Land Use Planning Commission for Alaska cannot yet be described as a model for comprehensive land-use planning, it has demonstrated a

willingness to act and commit itself, accommodated diverse interests, provided opportunities for public participation, and established an operational mechanism for conflict management. With current indications that the Joint Commission may be about to move seriously toward planning, it may yet become a model of effective intergovernmental land planning in what is probably the most critical resource region of the United States.

DISCUSSION

MR. ROBERT B. CURTIS: I have become interested in land-use planning, particularly on the state level, since I feel that state planning is important to wildlife. Therefore, I would like to ask Mr. Fischer whether or not he feels the interagency type commission made up of both federal and state people is preferable to the state commission? I know that a number of states this year, in light of Senator Jackson's bill, are working toward legislation that would provide a state land-use commission. We have a few throughout the country. The CEQ publication on *Quiet Revolution in Land Use Control* talked to that point and it looked as though many states were going for a state land-use commission.

Will you, therefore, comment on your impression, particularly in the light of the states in the West, where they have a number of acres of public domain land in comparison to states with more privately owned lands?

MR. FISCHER: The primary advantage of the Alaska approach is that it brings the federal and state agencies together. This, of course, is particularly applicable to the public land states because state agencies have limited scope and authority. They have no jurisdiction over federal lands.

The Jackson Bill for a National Land Policy would further promote state planning programs that are not particularly geared to public lands while we should be concerned with planning for all land on a statewide basis because of the interaction that is so important.

Arizona is probably a good example of where you have tremendous federal reservations and federal lands. The interaction between what is done on the federal lands and how they are used is, of course, critical.

The jurisdiction that you see evolving in states like Vermont and others, this deals with state activities and with essentially private lands. What we are concerned with, of course, is what is done on each of these categories of land—private, state, federal and native Indian land—and this particularly applies to a state like Arizona. In other cases, of course, a state commission may be much more appropriate.

The structure in Alaska also is important because it brings the Federal Government directly in with a Presidential appointee, with not just authority but, I might say almost a mandate to deal directly with the Department of the Interior and directly with the Congress and the President, so that you have a channel going in all directions. Further, the commission can make recommendations to Congress for possible a completely new system of land management, where one might depart from conventional ideas and possibly provide for integration of federal and state management of lands, fish and game, etc.

MR. CURTIS: In Arizona we started out with our land-use planning legislation to include only those state and private lands. We were effective in having the bill changed to read "all lands in the state," which includes about 25 percent Indian land and 44 percent federal land and that the plan itself is a document that would indicate the type of use we would like to see on lands at the state level. However, we have also included in the legislation the inputs of Federal Government and advisory.

I believe, that in the Congressional hearings last year on the Jackson bill, 632, there were a number of comments and concerns by Senators throughout the country

as to the dominance of the government insofar as the use of lands in a particular state were concerned. If you have read that Congressional Record you can understand the concern of many of these Senators.

I believe Senator Jackson mentioned that he indicated or intended the bill to provide state control over land use primarily instead of federal-state control.

MR. FISCHER: I don't think the legislation proposed any direct state control over federal lands. There are a lot of good intentions astted in that bill but few handles for active implementation.

The issue raised has to do with some of the basic problems and basic issues in planning itself. We can produce plans, and many good plans have been produced. But they do not necessarily bring results. We can say, for example, that this land ought to be used for this and that land for that but it is all advisory. Now, so lang as there isn't the direct participation and direct link to those who make the decisions, the implementation is not likely.

That has been a weakness in relation to planning and this is why I said at the beginning we have so few models of effective planning in use. What we have seen has really been very limited. It has been mostly at the level of a single government having total jurisdiction over its own area. Very seldom have we seen anything in any kind of multi-jurisdictional environment.

PROFESSOR WEEDEN: We are running extremely short of time but I would like to introduce to you members of the Commission who are here in the audience—Mrs. Celia Hunter, who is a member of the Commission from Fairbanks, Alaska and the State Co-Chairman; Joe Josephson and Mr. Harry Carter from Anchorage, Alaska. I would certainly be happy to hear from you if you would like to make any comments.

MR. JOE JOSEPHSON: I was not going to comment because I thought the paper as given was a balanced critique as to where we are in our process.

As we move into the next critical phase from a time standpoint, our recommendations on the 80 million acres of land under study for permanent reservation in four systems, we become more self-conscious of the need for systematic planning from an overall point of view of Alaska's future, which Mr. Fischer mentioned. That development has been helpful to us in making us more self-conscious of this requirement.

MR. STEWART BRANDBORG (The Wilderness Society): Conservationists recognize the achievement of the Native Claims Law in calling for the dedication of 80 million acres as one of the real triumphs of this century. Of course, the primary goal, on behalf of the other people of the country as well as those in Alaska, is to dedicate for park, wildlife, river and other public land purposes these areas which will not be maintained in their present condition in the absence of such reservations at this time.

Our speaker has emphasized several times the importance of public involvement in the development of preliminary recommendations for consideration by the Secretary in delineating those principal wildlife refuge park systems, wild river systems, etc., that he expects to present to Congress by the end of the year.

He also mentioned the importance of the public hearing process throughout Alaska and we know that the Commission plans to hold hearings, at least four of them in the lower forty-eight for the purpose of getting an expression of public and agency views in the contiguous states.

I would like to ask the speaker and the Commission at this time whether they will proceed to advance specific proposals for those park refuge and wild river systems at the time of these hearings.

It is my understanding, from Interior Department sources, that the Interior Department has precluded this kind of discussion because of its request for broad multiple use considerations being brought forward at the hearing in the absence of specifics as to which area should be placed in given refuges, parks, wild rivers or national forests.

It is obvious that such broad-based discussions, in the absence of specific proposals, will not be meaningful within the context of requirements of Congress

for specific data by the end of the year. It will not be meaningful for the benefit of the Secretary of the Interior as he faces his difficult decision.

We need specific proposals presented to the people in Alaska and in the lower forty-eight on those areas which should be given this kind of protection within the 80 million-acre plan today.

MR. JOSEPHSON: I would reply to Mr. Brandborg in this way.

First of all, the Secretary did indicate as a constraint on our procedure, first, that the Department of the Interior itself would not conduct public hearings of its own on the 80 million acres and, secondly, that agencies of the Department would not appear before the Commission in any kind of adversary role to make presentations reflecting individual agency proposals.

We see perhaps, some advantages by the procedure we have decided to follow. We hope to have the first phase presented in July, when we will be commenting to the Secretary on our views in relation to the eighty million acres, as to what management ought to allow in terms of land use or what ought to be barred or prohibited in terms of land use on these acreages.

Then, following phase one, we would review the Department's proposal to the Congress and we would have those, I think, well before December, and we would reserve to ourselves the opportunity to comment to the Secretary and the Congress in a second phase on the matter of management regimes and also possibly make recommendations for systems or combinations of systems.

In some ways, this procedure, while it is set by constraints that we did not impose on ourselves, may have some advantages in that any other procedure would have required us to first explain to the public what the four systems are, what their strengths and weaknesses and management policies are, and get the Commission involved in semantic arguments in which agencies might complain we had not fairly presented their policies or programs.

I think that dealing with specific agencies' proposals would also have invited a lot of anecdotal testimony from what the Park Service has done to me to what the Forest Service has done for me. We think there is a great deal of misunderstanding in Alaska about the four systems and this is reflected in some resolutions which we see in the State Legislature. Therefore, by leiminating the discussion of who will control the land in question and focusing, instead, on what will happen to the overall program, we can then have a more rational and objective first class discussion of what the national policy ought to be there.

MR. FISCHER: I will only add to Joe's comment that my experience in listening to general presentations to hearings and discussions and discussing directions with many people inside or outside of Alaska, indicates the Commission is right to deal with use and management regimes for each area. Because as we look at the national forest policies, as we look at the national parks and any of the other areas, we find that the National Park Service says, of course, if a specific use is desired, Congress could take care of that instead of having the usual park, we could have an ecological preserve in this region. Therefore, you are not talking about, necessarily, usual jurisdictions or traditional restrictions, because each of these proposals is going to Congress and at that time the basic parameters will be set and these can apply to any one of the four systems.

* * *

CANADA'S INVENTORY OF LAND-WILDLIFE CAPABILITIES

V. E. F. SOLMAN
Canada Land Inventory, Department of the Environment, Ottawa, Canada

A characteristic of developing countries is their increasing concern with the best methods of land-use planning. At one time, when the human population was much smaller than it is now, it was possible for nations to let development occur in a haphazard manner on the understanding that land and resources were abundant. If a few mistakes were made, the impact would be slight and the remaining resources could be better used as a result of the experience.

We can no longer afford casual mistakes. A variety of land-use planning processes have been developed in relation to the particular needs of different countries. Canada entered the field later than some European countries but earlier than some other parts of the developing world. Much of the earlier agricultural development of Canada took place after limited planning and some mistakes were made.

Canadian agricultural land use has been changing for the last fifty years and has evolved through many stages. In the late 1950's and early 1960's we began to realize that some earlier agricultural development had not been properly related to the capability of the land to support agriculture. The result was a great expenditure of funds and energy by individual farmers that had not been accompanied by appropriate financial returns.

In the early 1960's an act known as the "*Agricultural Rehabilitation and Development Act*" (ARDA) was passed to provide federal government assistance to improve the level of earnings of some agricultural enterprises in Canada. The Act outlined the problem and a number of possible solutions. It sought to select the most effective solution and put it into operation. To clarify the problem, studies were made across Canada, in the agricultural sector, to locate the areas with the lowest income levels so that the work could be concentrated on them. It was assumed that there were areas of low income in certain provinces. The study showed that there were areas of low income scattered right across the country and not concentrated in any one area.

Having located and mapped the problem areas, it was then desirable to learn the causes of the depressed earnings and recommend methods of improving the situation. Causes such as lack of education, poor health, age and family status of farmers, location of farms with respect to education, public health and other social services, and

finally quality of the land itself were all considered. As the data were examined, it was found that low cash return from agricultural work was often related to attempts to carry out agricultural activities on lands not well suited to that purpose. That finding demonstrated the need to look at the settled part of Canada in regard to the capability of the land to support different kinds of agricultural activities. Data from soil survey work and geomorphological studies formed a part of the physical basis upon which a study of agricultural capability could be developed.

Before agricultural capability studies were begun, it was decided that if agricultural capability were low in areas with an established population involved in agriculture then other types of employment should be explored. Then if a decision were made to terminate agricultural use of the land, it would be known for what purpose the land had capability. It was decided that alternate land uses could include forestry, recreation, and production of wildlife. A multiple resource capability inventory was needed.

The program, known as the Canada Land Inventory, (C.L.I.) was a pioneer effort for Canada and for the world. In it we developed and used techniques to map quantitatively the capability of almost a million square miles of Canada for agriculture, forestry, recreation, and wildlife. Capability is not limited by, or related to, land ownership, access, distance from population centers, transportation routes or present land use.

As I mentioned earlier, agricultural capability could be derived from data on soil studies coupled with information on weather, exposure and related physical factors. It was found in many areas, particularly the mountain regions of B.C., that microclimatic effects were much more important for agricultural capability than had been thought. Consequently, a network of meteorological stations had to be set up to provide critical data on length of growing season, frost-free period and day degree summations which varied widely between areas as little as a mile apart. While that work was going on, foresters, recreationists, and wildlife biologists were devising methods of categorizing land capability on their sectors of activity.

In the wildlife field it was assumed at first that one type of classification could be used. After a series of meetings and discussions which involved biologists from all provinces and the federal service for more than a year, it was agreed that land capability for big game (ungulates) and waterfowl should be analyzed and mapped separately. At the same time, the recreationists decided that, although they could quantify capability of land for swimming, boating, hiking, scenic viewing and a variety of other things, they needed better data

on the potential for exploitation of a key recreational factor, namely sport fish. A sport fish capability inventory was required. After much discussion a technique was developed to evaluate capability of the land (water) to produce sport fish.

Once agreement had been reached on how to do the work, it took additional time to train the specially recruited groups in each province to use the nationally-applicable techniques so that the results would be comparable across the country.

The Migratory Birds Treaty of 1916 determined a federal responsibility for migratory birds. Usage determined provincial responsibility for big game. The big game (ungulate) capability inventory was carried out by staffs of nine privincial governments (one province has no big game). The inventory of waterfowl capability was done in nine provinces (the resource did not warrant mapping in one province) by staff of the Canadian Wildlife Service, which bears responsibility for that resource. The sport fish capability was done by or for six provinces (which elected to carry it out). The C.L.I. program began in 1964. In the wildlife and sport fish capability field it involved work by up to 40 provincial and 17 federal biologists and technicians.

The capability mapping programs for waterfowl and ungulates as well as those for forestry, agriculture and recreation involved an enormous amount of air photo interpretation. That was related to field studies to ensure that the air photo data were properly interpreted in relation to field conditions. Comprehensive reviews of soil, biophysical and meteorological data were also carried out.

A capability rating was expressed, in a seven class system (four classes for sport fish). The seven classes ranged from good (1) to bad (7). For values other than 1, qualifying letters were assigned to indicate the factors responsible for the rating (subclasses).

To classify the ability of land to produce and support ungulates, such environmental factors as quality and quantity of food, protective cover, and sufficient space for reproduction, growth, and survival were taken into consideration. Three additional special classes show land suitable for breeding, but used primarily as winter range.

Subclasses show which necessary factors are lacking, and denote why an area has been given a certain rating. Four subclasses are related to climate (for example, aridity and snow-depth) and seven to land (for example, fertility and soil moisture). Class one has no subclasses because all conditions are favorable.

Land capability for waterfowl is similarly rated in 7 classes, but as their production and survival needs differ from ungulates the details are different. Four additional special classes of land capability for waterfowl include three for land suited to production but also used

for resting during migration, and one (class 3M) signifying land unsuitable for bird production but good for stop-overs. To those were added subclasses and specialized categories to describe why the ratings were made.

Mapping was done at a scale of 1:50,000 initially, and consolidated at a 1:250,000 scale. Maps in the agriculture, forestry, recreation, big game and waterfowl series are published in color at a scale of 1:250,000 for sale to the public at 50 cents a copy. They are popular with the public as well as with the planners and senior officials of government concerned with broad land planning.

The data at 1:50,000 were collected primarily for detailed planning. They were inserted into computer storage facility from which they can be extracted as needed. The computer program permits grouping of any series of data on single maps and includes data on present land use and various kinds of social, political and economic data on the human population. Because of problems with the computer, not as much use has been made of that facility as was originally planned. Certain provinces now have their data in the computer bank and for them the computer can provide a variety of kinds of output data which have been particularly useful for land-planning decisions.

After the popularity of the 1:250,000 maps was well established, it was decided in 1971 that for educational purposes and for decision making at the highest level, slightly simplified maps at a scale of 1:1,000,000 would be useful. Those are in preparation now, and will soon be available to administrators and the public.

The printed maps for public use are produced in color so that differentiation between the various kinds of capability is quite apparent. Typical waterfowl and ungulate maps are quite colorful. It is easy to pick out the areas of major importance. The program, which is now almost complete, has involved the expenditure of slightly more than $20,000,000 over a seven-year period. When you consider that we got for that money nearly 200, 1:250,000 colored map sheets for each of 5 sectors covering an area of almost a million square miles the cost per square mile, per sector was less than $5.00.

It would have been better to have had the land capability data before the agricultural development of the country began 250 years ago and social and political patterns were established, sometimes in the wrong way. We now know how to avoid future mistakes of that kind. We have the data to ensure that, as land use changes occur, they can relate properly to the resource base on which all development ultimately rests. There is no longer reason to make the kind of

land-use mistakes we used to make because we did not have the basic information.

What about correcting some of the earlier land-use mistakes? That too is being done. Many of the provinces are already in the process of changing some land uses. Some are buying up lands with low agricultural capability that were in private ownership and were used for agricultural purposes. Buying those lands back into public ownership frees the people who had been trapped on those lands and who could neither sell them or make a living on them. Those people can now afford to move to other employment and more rewarding lives. Lands are being taken out of agriculture by provincial governments and put to uses for which they have greater suitability. Some provinces are buying low-capability agricultural land at rates in excess of 60,000 acres per year. The importance of the human suffering and frustration that is being relieved by that means is great.

We all face a heavy emphasis on recreation and use of wildlife resources. I believe we can agree on the value to wildlife of some of the land made available for wildlife use by being withdrawn from agriculture. It is good to know that we have a method that can ensure that we make fewer mistakes in future land-use decisions than we have in the past.

A number of states have already expressed interest in our techniques and have asked for detailed information on parts of the program. We have also had inquiries from more than 20 other countries.

In parts of Europe, land management has been going on for centuries and you would think that through experience the best land use would already be in effect. Some countries there have expressed great interest in the techniques we have evolved and used in the C.L.I. They have taken our techniques and begun land-capability inventories on areas where hundreds of years of management had not reached the most effective ways to use the land.

I have given you a brief outline of why Canada got into land capability mapping and analysis. I have explained something about the techniques we used, how the work was done and the results prepared for presentation.

We believe the most important thing about the C.L.I. is that the data have been and are being used in land-use planning. The program developed a classification system, not for its own sake but as a tool for planners, which they are using, increasingly. We have not developed the only method of classifying land capability and doing land capability analyses. We do have a method that has worked well for us. The fact that others are already applying parts of our system to deal

with their problems indicates they think we have something useful to offer.

DISCUSSION

PROFESSOR WEEDEN: Thank you very much, Mr. Solman, for that presentation. I would like to point out what I think are three extremely important elements in this presentation.

First of all, there is the absolutely huge scale of the effort; secondly, the fact that the project was conceived with a distinct and articulated social goal relating to agricultural income and that this goal has been furthered by results of the project; and, thirdly, that the maps are widely available to members of the public and this is one of the most important factors. They are available to that class of people who are making land-use decisions in the provinces and also the various local municipalities and on other local efforts.

MR. SKIP BRADEN: You mentioned a figure of approximately five dollars per square mile. Is the total cost to produce the maps shown here?

MR. SOLMAN: That is the total cost including surveys, field programs, printing and the whole business—perhaps give or take fifty cents.

Remember, that is for one sector and we have presently dealt with five sectors in total. Of course, the cost for all 5 sectors would be five times that, roughly between 20 and 25 million dollars for a million square miles in the five sectors.

We did, I might point out, something that has become obvious to most people—that is that this work was done before the earth resources technical satellite was available and this is the implication of the two papers, the one we have just heard and the one we are about to hear.

MR. CURTIS: I believe you just answered my question because I was going to ask that same question. You did not, as I understand it, utilize high-altitude photography?

MR. SOLMAN: Not as high as that available now. We utilized conventional aircraft at the lower altitudes.

* * *

THE NEW TOOL IN RESOURCE MANAGEMENT

ARCH B. PARK

Earth Resources Survey Program, Office of Applications, National Aeronautics and Space Administration, Washington, D. C.;

EDWARD BERARD

Ambionics, Incorporated, Washington, D. C.; and

CHARLES CROTEAU

Space Systems Division, General Electric Corporation, Beltsville, Maryland

In July, 1972, the United States launched the world's first satellite devoted to periodic observation of the Earth's resources. Agreements or contracts were made with over 300 people or organizations to investigate the potential uses of the observations provided by the Earth Resources Technology Satellite (ERTS-1). Over 100 of these investigations are being conducted by countries other than the U.S. with data provided by the U.S.

At this time thousands of pictures have been provided to the investigators which include wildlife and fisheries specialists, foresters, agriculturists, ecologists, geologists, engineers, cartographers and planners. All pictures have been made available to the public for the cost of reproduction at two data centers. Pictures of the land and shoreline areas may be ordered from the U.S. Department of Interior's Earth Resources Observation Satellite (EROS) Data Center in Sioux Falls, South Dakota. The other center is the Department of Commerce Data Center for Oceanographic and Atmospheric Data at Suitland, Maryland.

Basically there exist on the ERTS, three unique features brought into resource inventory and monitoring for the first time. These are spatial coverage of 34,000 square kilometers (13,500 square miles) on each image frame; the repetitive coverage of any area on Earth every 18 days, and 4 spectral bandwidths ranging from green to near-infrared.

The ERTS-1 is still classified as experimental rather than operational, but significant results are beginning to emerge in some disciplinary efforts while in other fields it is too soon to draw conclusions.

In Alaska two wildlife programs are underway employing ERTS-1 imagery. One, under the supervision of Bill J. Van Tries of the Bureau of Sport Fisheries and Wildlife, is evaluating the impact of caribou on its range and attempting to identify and monitor waterfowl nesting areas. Within the scope of this experiment, the detection and impact of annual climatic changes, oil development, highway

construction, pollution, fire, and river and coastal developments are being carried out to obtain data on those forces that may adversely affect migratory waterfowl and terrestrial and marine animals.

The second experiment also involves caribou. NASA is supporting the studies by Peter C. Lent of the Alaska Cooperative Wildlife Research Unit of caribou movements and winter dispersal in relation to snow cover.

AGRICULTURE/FORESTRY/RANGE RESOURCES

Crop and forest species can be discriminated by analysis of the data being acquired by the multispectral scanner, but only to the degree that the crop types are separable, not below this level. Crop calendars can be developed and crops identified, but launch data prohibited the calendar development and we will have to wait until spring to do this. Crop calendars refer to the technique of identifying crop types by using the knowledge of planting dates, growth characteristics including harvest dates. This is very different for many economic crop types. The forest species—deciduous vs. coniferous trees—can be separated, but we will again have to wait until spring leafing out to determine how much more can be done.

Vegetation stress has been detected in a forest stand which was recovering from the effects of exposure to defoliant spray. Computer analysis of ERTS-1 data detected the stressed stand even though it could not be discerned by visual observation from aircraft.

Surface soil color patterns can be observed. Relationship to soil survey has yet to be established for broad areas. Relationships have been established in Indiana only.

For more than 15 years, 18 Agricultural Experiment Stations have been organized into two regional research groups, which have established phenological network stations and have accumulated a vast amount of data on the procession and decline of foliage development over wide areas of North America. Elaborate and expensive statistical sampling techniques can be used, but the awesome spatial area of the satellite imagery coupled with the omniscience of any sensed image be it photograph, radar, or television (The truth is there—we have to dig it out) supersede statistics. It is ridiculous to analyze the statistics and probabilities of a 100 percent sample.

The two regional groups brought together specialists in the life sciences co-ordinated by Dr. Bernard E. Dethier of Cornell University. This continental scientific team is concentrating on determining how remote sensing of the phenological changes of natural vegetation is being applied to agricultural and forest management. The problems here, as elsewhere, are twofold, what can be applied *now,* and what is

"*normal.*" NASA stands ready to offer its assistance, but those in attendance at this conference and their conferees working at home must give us the directions in our Applications Program. Dr. Dethier, at the time of this writing, is pulling together the experiences of his colleagues, spectral responses from not only space, but the NASA aircraft support program of high and medium altitude aircraft, and intensive ground investigations for documentation at a large number of selected test sites. Dr. Dethier anticipates, from his studies, methods of predicting methods and chances of success of introducing new fruit crops in specified areas and control of big sagebrush in the West which competes with grasslands. The latter activity, if successful, should reduce the indiscriminate usage of herbicides. Other predicted benefits include determining the dates when cattle can be put to permanent grazing, and the control of the alfalfa weevil in terms of the cutting schedule predicated on phenological sentinals. The four major corridors under investigation are:

1. *The Appalachian Corridor*—Maine to central North Carolina, bordered on the west by West Virginia.
2. *The Mississippi Valley Corridor*—from southwestern Michigan, central Indiana, eastern Oklahoma, and College Station, Texas.
3. *The Rocky Mountain Corridor*—from northern Montana due south to mid-Arizona.
4. *The Columbia Valley Corridor*—from southwest Montana west to the Pacific Coast and then south.

As an offhand comment, the similarities between our picking *seasonally oriented* natural corridors, seems similar to those flyways selected naturally by waterfowl.

LAND USE SURVEY AND MAPPING

Classification schemes for using ERTS data for land-use mapping have been developed. They have been used successfully in California and Rhode Island. The land use map of Rhode Island was created in 40 hours from ERTS-1 images. The data in the map are up-to-date as of the time the observation was made. Land-use maps produced by conventional means may be obsolescent in many important details—such as extent of urbanization—at the time of printing because of the rapid changes and the many months normally required to assemble data. Also, the local nature of conventional land-use mapping leads to variations in data bases which increase the difficulty of intercomparison on a national basis. ERTS does provide a common data base for national land use analysis. Additional work will need to be done next spring and summer. Although classification schemes can and should be uniform on a national and even international basis it

will take wide experience with the approach to develop general acceptance by the user community.

CARTOGRAPHY

The demonstration that highly accurate maps can be made from ERTS-1 imagery is an important result which has been demonstrated. ERTS-1 can map at a scale of 1:250,000—four times better than the design goal of 1:1,000,000. Maps made from rectified ERTS images accurately depict landforms and geological features and show the locations of necessary map details, such as rivers, lakes, cities, and coast line details. The extraordinary rate at which ERTS-1 produces map-like images, each one accurately depicting 34,000 square kilometers of the Earth's surface, is a significant cartographic advance. The demonstration of repetitive coverage of continental size areas every 18 days, reveals an unprecedented method of updating existing thematic maps, as well as for obtaining fundamental cartographic information about poorly or incompletely mapped regions. Maps of rapidly changing, but important phenomena, such as coast lines, are especially difficult to keep current because of the time involved in conventional mapping surveys. Recognizing the potential of ERTS-1 data for this use, the U.S. Corps of Engineers has requested that coast line images be made available to them. The University of California investigators have documented the fact that the analysis and preparation of a vegetation map was 19 times faster with ERTS-1 than with even high-altitude aircraft photography which was only a factor of two larger in scale.

Land use is perhaps the most important area of all, in terms of public interest. This type of mapping, usually called thematic, addresses itself to what is there rather than where the boundaries are located.

Dr. Robert B. Simpson of Dartmouth College working with the EROS Census Cities Project (Headed by James Wray, USGS) has stated, "The rapid outward thrust of land development around our cities is due in part to our rapidly growing population, but even more to the fact that the amount of land required per capita is increasing at an even faster rate."

Accelerating land consumption includes some of the most stressful problems of our times: sprawl, pollution, ghettos, other urban problems, and rural exploitation.

Dr. Simpson, heading up a study of the problem of expanding cities in New England, has an ultimate objective of an optimum urban land use planning program.

This is a continuation of an earlier Dartmouth College project

which used high-altitude aircraft photography to create a land use-map of the greater Boston area covering over 100,000 square miles. The mapped data have been computerized. From the resulting data bank, planners may extract information for individual or combinations of 90,000 "cells," each approximately 10 acres in size. Information on transportation, utilities, industrial, commercial, and residential areas is available as well as vegetative cover, water, recreation facilities, etc. The ERTS data is entered in a form compatible with the existing system.

Out in Wisconsin, a group of scientists are working with Dr. James L. Clapp of the University of Wisconsin. They anticipate that ERTS will offer "means by which the data acquisition process can be immeasurably improved." This interdsiciplinary group is using ERTS-1 imagery "as a base for environmental monitoring and the resolution of regional land allocation problems."

The state is being studied as three geological regions for purposes of land use planning; Madison, Milwaukee, and where the state and the Great Lakes are contiguous.

At the time of this writing the Wisconsin group has developed methods to compare statistically and spatially ERTS data to conventional sources.

MINERAL RESOURCES

Fracture patterns have been observed, that don't appear on existing maps, illustrating the great potential imagery from space has for improving geological maps to include previously unmapped features.

Field work has been done and it verified the existence of the faulting and folding as indicated on the ERTS data.

Regional and continental geological studies can be enormously facilitated by images taken from space. For example, the synoptic view provided by ERTS-1 achieves complete United States coverage with only 500 pictures. Similiar coverage from aircraft would require about 500,000 pictures and would involve all of the sun-angle, look-angle, and rectification problems inherent in aerial photographic mosaic construction.

The uniquely uniform look and sun angles at which ERTS-1 images are made, allow interpretation of subtle tonal variations over large surface areas. Geologic structures which are associated with mineralization, such as the circular zones sometimes related to porphyry copper, as well as fault lines, can be seen and traced on a regional basis. No actual mining has yet resulted from these data although aero magnetic surveys have verified the existence of strong magnetic lines of force associated with the surface feature.

Exploration for minerals and fossil fuels is not the only area of geologic import.

The Great Smokies Mountains National Park, concerned with increasing visitor usage, is seeking additional supplies of good quality water for rest rooms and drinking fountains. Ground water in this area (Eastern Tennessee and North Carolina) is of good quality and cheap to develop, but most of the wells produce only a few gallons per minute. The exception are wells that intercept rock faults which produce up to several hundred gallons of water per minute. High quality geologic maps are available for the Park and large faults have been mapped. Soil covering has obliterated many rock formations so that the locations of many fault segments are unknown and many smaller faults are overlooked. U.S. Geological Survey plans to employ SKYLAB sensors for ground water prospecting in this heavily wooded mountain terrain.

ERTS experiments in the area of Boston, Massachusetts now underway by Dr. Frank Wobber of the Earth Satellite Corporation have already indicated predictable yields of water wells and problems in excavation and construction. This has been accomplished through fracture analysis of the Boston area imagery.

WATER RESOURCES

The quantity and quality of water available for drinking, industry, recreation, agriculture, and wildlife, has never been over-abundant, and in recent years has become increasingly difficult to obtain. Indications are that substantially greater efforts will be needed in the future to maintain a satisfactory supply as demand increases. Exploration to discover new sources is required. The images from ERTS-1 have been used to detect underground water sources in Florida by the effects subterranian water has upon surface vegetation.

For surface water mapping the land water interface is very clear in the infrared band of ERTS-1. Surface water area measurements are very good and reservoir levels can be monitored.

Snow surveys can be efficiently made from ERTS-1 images. Snow is a primary water source in many countries including the United States and the seasonal discharge or retention of water from impoundments must be based upon estimates of the amount of snow yet to be melted. The snow lines can be estimated to within 10 meters and meets the operational accuracy needed by agencies such as the Bonneville Power Administration. The repetition rate of ERTS is however too infrequent for maximum utility. These data are being supplemented with weather satellite data on a daily basis.

Reservoirs gradually fill with sediment and their capacity for

storage decreases. The rates at which sedimentation takes place is of great economic importance, but difficult to estimate.

Research has established a linear relationship between tonal response in photographic images and the amount of sediment. It is expected that a practical methodology for estimating sedimentation rates will be developed based upon the repetitive coverage and synoptic view afforded by ERTS-1. It will take several years of empirical observations supplemented and verified by surface measurements in order to establish confidence in the approach.

The playa lake area in west Texas and New Mexico is increasing in importance as over 70,000 wells are rapidly depleting the underground water supply of the major acquifer (the Ogallala Formation). This is threatening the economy of one of the major cotton and grain sorghum production regions in the United States. The 20,000 intermittent lakes (playas) may provide additional water. Presently it is unknown what percent of the water evaporates, seeps into the aquifer or is utilized. The sheer physical size of the problem (91,000 sq. kilometers) makes conventional means of inventory of these potential water resources extremely costly and time consuming. A team of scientists from Texas Tech University and assisted by the U.S.G.S. is already reporting findings of value from the satellite data. For example, the number of intermittent lake basins filled by a storm, and the path of the storm. During wet periods the ERTS imagery provides a reliable count of the tens of thousands of natural lake basins on the southern high plains.

MARINE RESOURCES

ERTS-1 data have been interpreted to provide valuable information about the ocean. The presence of fisheries is related to the nutrient qualities of the sea water. The nutrients provide food for the chain of organisms upon which commercial fish species depend. Chlorophyll are usually associated with the presence of fish. Chlorophyll has been detected in ERTS-1 images of ocean areas off the West Coast of Africa. We do not, however, yet have the capability to detect low enough levels of chlorophyll to be operationally significant to fisheries.

The unlimited use of the ocean as a sewage and refuse dump has become of concern. There is increased evidence that various chemicals dangerous to man may be retained by edible fish and that the complex life system of the ocean may be irreversibly damaged. Space deployed monitoring of dumping has been demonstrated by the ERTS-1 image of the New York Bight for a practicable method of surveying the effects and use of the ocean for disposal of wastes will require daily observations along the coast. Studies are underway on the design of a

satellite/sensor system which would combine the requirements of daily observations with ERTS-1 quality over just the coastal areas.

The principal direct economic utility of the ocean is shipping and substantial effort is undertaken to observe and forecast ice conditions in the northern latitudes. The formation, break-up and movement of sea ice must be repeatedly observed and reported. Sea ice monitoring in the Arctic has been demonstrated with ERTS-1 data but the data are not satisfactory from a repetition rate basis. At high latitudes ERTS-1 has 90% sidelap permitting 10 days of repetitive coverage but 8 days without coverage. For navigation purposes this is unacceptable.

The National Oceanic and Atmospheric Administration (NOAA) employing aircraft has tied in identification of the plume from the Genessee River into Lake Ontario with infrared and clarified sediment structure on the northern Lake Erie shore. The ERTS-1 component of the same program revealed on one frame a thick algal mat several hundred feet wide and 10-15 miles long in Lake Erie. Such a sighting had not been observed and verified.

NASA scientists in conjunction with the University of Delaware College of Marine studies have derived a process to separate the spectral signatures of turbid and chlorphyll rich ocean water. ERTS-1 data taken off the Northwest Coast of Africa show the chlorophyll structure in that area is more complicated than expected. The ERTS imaging showed very fast changes in chlorophyll distribution.

ENVIRONMENTAL QUALITY

Environmental quality cuts across all of the previously mentioned disciplines. Significant results resulting from ERTS in this discipline vary and in many cases require further investigation. Exceptions, such as possibly the study of the dumping in the New York Bight mentioned previously, exist. Pollution, being a dynamic rather than a static problem, requires monitoring as well as detection.

Environmental quality programs underway range from estimates of prairie burn near the Sand Hills of Nebraska to wetlands along the Atlantic Seaboard and smog and haze detection over metropolitan areas. Strip mining is being watched in Ohio and Indiana, and Dr. Aulis Lind has recorded a pollution plume in Lake Champlain in ERTS bands 1 and 2. The source is alleged to be a paper mill on the New York shoreline. The State of Vermont will use this ERTS observation as evidence in pending legal action.

GENERAL

All reports rendered to NASA by ERTS-1 investigators are placed in the open literature and are available to you through our Depart-

ment of Commerce. A Department of Commerce publication called "NASA Earth Resources Survey Program Weekly Abstracts" is readily available and lists all NASA sponsored investigation reports. It further has a section entitled "Reports Containing Author-identified Significant Results." We hope that this publication will be a real aid to you in the Resource Management field. I commend it to you.

I am sure the question of resolution will come up. We are experiencing surprising results with unclear exploration. The system was designed for 125 ft. resolution but we are locating and identifying items under 50 ft. This phenomena is under study.

In reiteration at this time we do not have a cure-all. The satellite program is a tool to supplement and aid existing systems.

DISCUSSION

CHAIRMAN WEEDEN: I would like to address a question to Mr. Berard which relates to something some of you, I believe, have seen in a recent issue of *Ambionics* magazine an article by a Dr. Lundstrom, who was talking about the very many uses to which this remote sensing and satellite imagery could be put.

He also referred to what he called a certain sensitivity that some nations may feel when overflown by satellites that are making inventory surveys with economic implications.

He says that the data available from some of these pictures are so useful to resource exploitation firms that they give those firms, in effect, a capability to make investments and commitments in underdeveloped countries which far exceeds that which we now have.

The question then would relate to the social and international implications of the use of the earth's imagery.

MR. BERARD: I am glad you asked the question. Not being a lawyer, I don't know what the answer is. However, one of the most important features of this program is that nothing will be taken over a country without that country's permission and in many cases that has been forthcoming. In other cases it has not. This is not for military use.

Perhaps I can elaborate a little further. Many times, for example, we have a third-party type of program—wherein, for example, we may supply the imagery to a firm in Germany which, in turn, might want to take pictures in the Sudan. However, before so doing, we have to have written notification from the Sudan that it is permissible to take pictures for that particular project or that particular organization.

However, things like this are just not happening on a large scale. As a matter of fact, strangely enough, I would have thought there would have been more comments on this. However, actually, we are working in cooperation with the Russians. Likewise, the Egyptians have been highly favorable to the program and I think this will continue.

* * *

PLANNING RESOURCE ALLOCATION IN STATE FISH AND GAME AGENCIES[1]

ENOCH F. BELL AND EMMETT F. THOMPSON
Division of Forestry and Wildlife Resources, Virginia Polytechnic Institute and State University, Blacksburg

For efficient planning, it is essential that managers know the consequences of their actions before they can intelligently evaluate alternatives. It follows then, that planning for intensive resource management requires knowledge of functional input-output relationships. In the case of state fish and game agencies, the inputs to be considered include: budget expenditures, the current level of access, present fish and wildlife populations, and agency regulations and laws. The resultant outputs should be expressed in some measure of consumer satisfaction.

Unfortunately, need for the above relationships does not appear to have been well recognized with the attendant lack of emphasis on developing appropriate input-output functions. This paper discusses our efforts to alleviate, somewhat, this lack of recognition by quantitatively linking fish and game agency expenditures and management actions with the resulting man-days of recreation.

The specific objective of our research has been to develop and demonstrate the implementation of a methodology which will predict the outputs accruing to state fish and game agency activities and expenditures. The implicit assumption behind the research has been the understanding that improved resource management planning would result from use of the appropriate input-output relationships.

THE PROBLEM

Unfortunately, many fish and game agencies are not in a position to plan effectively for the allocation of monies and other resources based upon the human benefits which will derive from agency programs. In the past, the decision environment has not required consumer-oriented output considerations. Thus, fish and wildlife biologists have only recently recognized the need to develop the additional precision, information, and models needed for planning and management from the consumer's point of view. Biologists can measure browse production per acre but have no reliable means for relating this to either future deer populations or, more important, to man-days of hunting. They can survey pheasant populations but do not know how dollars of habitat improvement quantitatively change these populations. In essence, production functions which relate the inputs by fish and

[1] The authors are indebted to the Federal Aid Division, Bureau of Sport Fisheries and Wildlife, U.S.D.I. for funding this research.

game agencies to the ultimate consumer's satisfaction are not available. For example, deer population models have been developed (Walters and Gross 1972) but no one has attempted the more important and closely associated consumer management model. As a result, it has not been possible to design planning systems for aiding state fish and game managers in the optimization of the human benefits derived from their limited budgets and other resources.

MANAGEMENT PLANNING THROUGH SIMULATION

In planning it would be desirable if the manager could experiment with the various available alternatives without suffering the results of a real-world situation. The management tool known as computer simulation provides just this opportunity. Computer simulation displays the results of various actions and allows the manager to observe the effects of various decisions without worrying about receiving irate letters from disappointed consumers or perhaps getting fired. He can ask "What if?" and obtain an answer without the problems associated with experimenting in the real world.

Computer simulation has a number of other aspects that make it a desirable methodology. First, experimenting with a computer simulator is cheaper than experimenting with the real world. Second, a simulator can be very flexible, allowing modifications in the model with a minimum of effort. Third, different levels of precision may be used within the simulator according to the sensitivity of the outputs to each function. Finally, simulation is not as restrictive mathematically as other management tools such as mathematical programming. This allows more diversity of functions where necessary to more accurately reflect the real world. As a result of these considerations, we chose computer simulation as the most appropriate means of meeting our objective requirements.

MODEL DESCRIPTION AND RESULTS

To obtain data and a case study vehicle for developing a computer simulation model, working arrangements were established with a state fish and game agency. The Michigan Department of Natural Resources, specifically the Department's deer management program, agreed to cooperate in this aspect of our study.

The procedure to accomplish our objective has been to first develop an overall model or framework from *a priori* information, then program the framework for computer simulation and finally input the appropriate data to allow the simulator to function. The framework and data for the simulator have been obtained from three areas. Most of framework was synthesized from work by Haulsee (1973),

Kennedy (1971), Peterle (1961), and Ryel (1969, 1970) in the area of hunter management, from Giles and Snyder (1970) and Eberhardt (1960) in the area of deer management, and from discussions with Michigan Game Division personnel regarding the overall system. The data to implement the framework were derived from numerous publications such as those of Eberhardt (1960), Palmer (1967), and Bennett (1966), from empirical data gathered by the Michigan Department of Natural Resources Research Division, and from subjective judgments by biologists involved in the management of Michigan deer.

The computer simulator has been constructed from the framework shown in Figure 1 which indicates the simulator's structure. Basically, the simulator consists of three parts: the environment, the

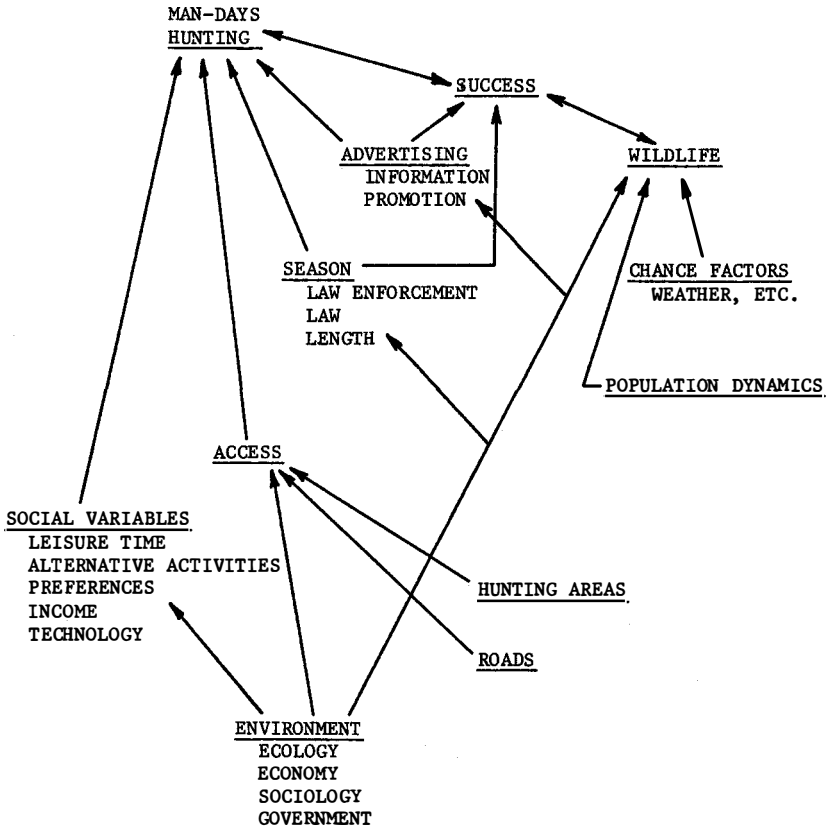


Figure 1.—Man-days hunting production function.

hunters, and the deer. The environment for this particular case is Michigan with its associated ecological, economic, social and governmental structures. The hunters and deer are manipulated and respond within the environment.

The deer hunter man-day portion of the simulator calculates the number of hunters and the average number of man-days per hunter and multiplies these two numbers together to get total man-days of deer hunting annually. The number of hunters is considered to be a function of time, level of license fee, season length, weekend season opening, land accessibility, information dissemination and promotion, law enforcement level, and hunter success in previous seasons which, in turn, is dependent in part on deer population. The average number of man-days per hunter spent deer hunting is limited by the length of season and is a function of leisure time available, land access, and weather. The separation of the number of hunters from the average number of man-days was considered to be appropriate because each is affected differently by the variables.

The second part of the simulator is concerned with deer population production and harvest. The initial deer herd is annually increased or decreased according to the relative levels of natality and mortality. Natality in this simulator depends upon the number of does, doe natality rates by age classes, and forage levels. Mortality can occur in a number of ways. Winter losses are proportional to the ratio of total browse available to total browse needs. Other losses are directly proportional to population levels. The deer harvest is a function of season type, population level, hunter effort, and kill per unit effort. Illegal kill is calculated as a proportion of the deer harvest.

The simulator output is the estimate of the total number of deer hunter man-days generated by years. The simulator can also output the initial data, the results of the man-days calculation, the results of the deer population production and harvest calculations and/or graphs of deer and hunter numbers over time, depending on the options selected.

In order to give an indication of the simulator's functioning, two illustrations of the output are shown. Figure 2 shows the number of hunter man-days produced over time assuming that the real level of the deer management budget is constant and the game agency allocates it evenly among land acquisition, law enforcement, promotion, and habitat improvement. Figure 3 shows what the output would be if habitat improvement and law enforcement were emphasized in a declining real budget at the expense of acquisition and promotion. Further variations in output can be produced by additional changes in the budgets, type and length of season, and license fee charged.

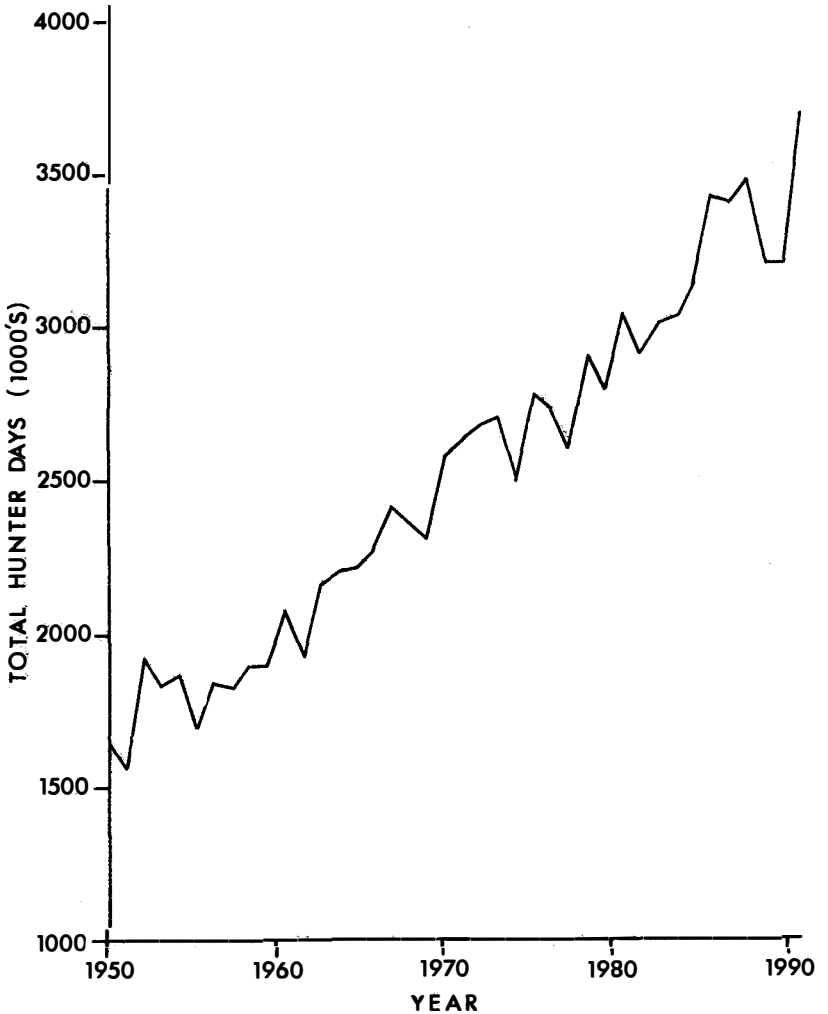


Figure 2.—Total Michigan man-days of deer hunting over time given a constant budget emphasizing each management activity equally.

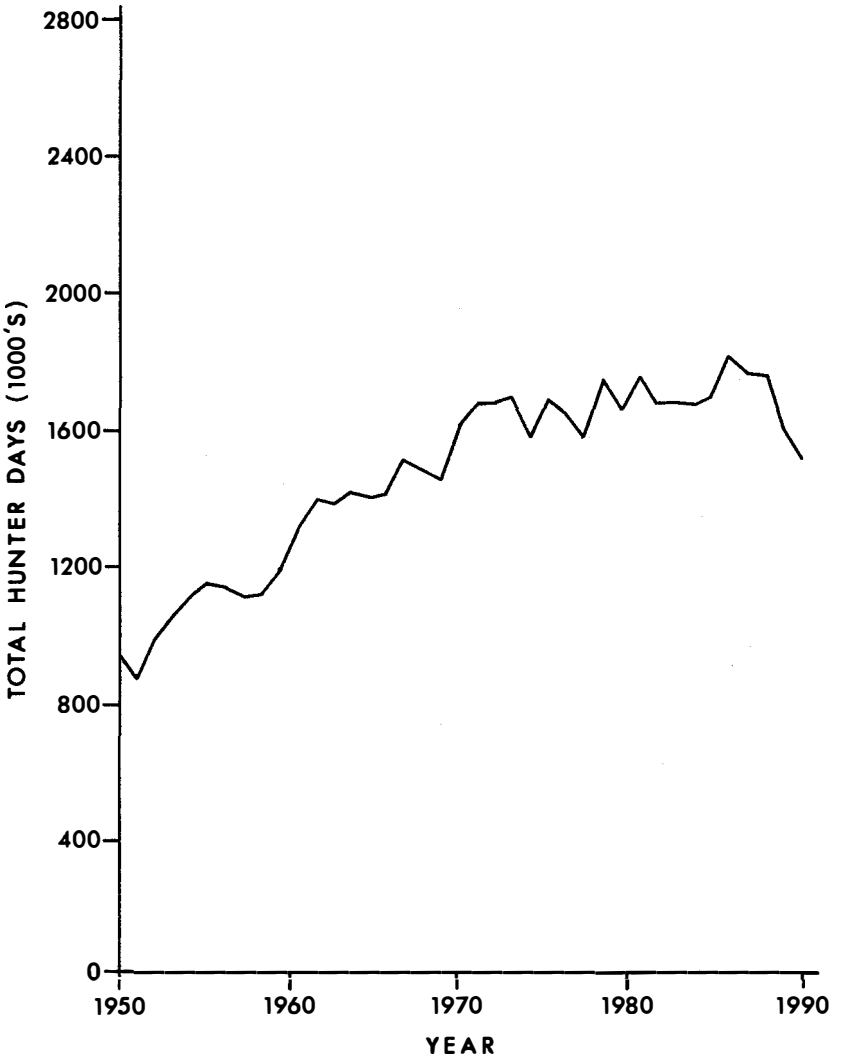


Figure 3.—Total Michigan man-days of deer hunting over time given a declining budget emphasizing law enforcement and habitat improvement.

PROSPECTS FOR FURTHER DEVELOPMENT

Preliminary reaction to the simulator and its use has been favorable. It appears to fill a need by linking inputs by state fish and game agencies with outputs expressed in terms of deer hunter man-days. In addition, it also allows manipulation of inputs to determine the consequences which would most likely result from similar actions in the real world.

As a result of our initial success in designing the deer hunter man-day simulator, we have been encouraged to expand our approach to other species and states. We are now in the process of applying the same modelling procedure and model framework to small game species. At this point in time we foresee availability of data as our major constraint in further development and will need and plan to rely more heavily upon subjective judgment of experts. Our final results will probably consist of documentation of a general set of techniques and procedures that the state fish and game agencies can apply to their own particular situations. We will not attempt to implement specific models for each set of circumstances.

Another useful development would be to add a subroutine which could optimize the output (deer hunter man-days) for given levels of inputs over specific planning horizons. Most state fish and game agencies seem to have little direct control over their level of inputs. Therefore a social optimum does not seem appropriate for the simulator at least initially, and the budget could be assumed fixed. That is, man-days of deer hunter recreation could be maximized subject to the fixed budget constraint. The optimizing technique could operate by sampling the output surface generated by the simulator searching for areas of maximum output. These areas would then be more closely searched for the maximum within the area. Subsequently, these maxima for each identified area would be compared to determine the greatest number of man-days of deer hunter activity for the given level of inputs. We recognize the inefficiency of this technique, but at this time are not aware of any other feasible alternatives.

In summary, we feel we have developed a useful planning tool for deer management in Michigan. Now we seek to expand its application to other species and other states.

LITERATURE CITED

Bennett, C. L., L. A. Ryel, and L. J. Hawn.
1966. A history of Michigan deer hunting, Report No. 85. Michigan Department of Conservation, Lansing.

Eberhardt, Lee.
1960. Estimation of vital characteristics of Michigan deer herds, Report No. 2282. Michigan Department of Conservation, Lansing.

Giles, R. H. and Nathan Snyder.
1970. Simulation techniques in wildlife habitat management, (mimeo.). Virginia Polytechnic Institute, Blacksburg.
Haulsee, Hada V.
1973. A motivation survey of Michigan deer hunters. M.S. thesis. Virginia Polytechnic Institute and State University, Blacksburg.
Kennedy, James J.
1971. A consumer analysis approach to recreational decisions—deer hunters as a case study. Ph.D. dissertation. Virginia Polytechnic Institute and State University, Blacksburg.
Palmer, Walter L.
1967. An analysis of the public use of southern Michigan game and recreation areas, Report No. 102. Michigan Department of Natural Resources, Lansing.
Peterle, T. J.
1961. The hunter—who is he? Transactions, 26 North American Wildlife and Natural Resources Conference. Wildlife Management Institute, Washington, D. C.
Ryel, Larry A.
1969. Deer hunters' opinion survey, 1968. Report No. 190. Michigan Department of Natural Resources, Lansing.
————, G. C. Jamsen, and L. J. Hawn.
1970. Some facts about Michigan deer hunters, Report No. 197. Michigan Department of Natural Resources, Lansing.
United States Congress.
1970. Federal aid in wildlife restoration. Public law 91-503. Washington, D. C.
Walters, C. J. and J. E. Gross.
1972. Development of big game management plans through simulation modeling. The Journal of Wildlife Management (36(1):119-128.

DISCUSSION

MR. JACK GROSS: I know that flow charts can be deceiving but I would like to know what sort of connecting mechanism you have between the condition of your habitat and the condition of your population dynamics as you simulate it? In other words, what is the tie-in between those two factors?

MR. BELL: I see why you are concerned about this.

We are working on the energy flow concept that a deer weighs so many pounds and will, therefore, consume so much energy. This way we use average weights for the various age and sex classes of deer and then, in turn, multiply population by weights in order to get the total energy requirements and, in turn, compare that with the energy we feel will be produced by the area.

Of course, we are looking at this strictly through the winter time because we feel that it is the limiting factor for northern deer.

MR. GROSS: What is your link between the populations?

MR. BELL: Given the population and its effect on the food supply—the way we have it set up it will have no effect until it becomes large enough that some of these deer are starving off and then the effect is proportional to the starvation level of deer.

MR. GROSS: How closely did you find that data that was required to run your model? How closely does this match the available standards and collection items for management agencies?

MR. BELL: In terms of the deer we have had fairly good success for that biological portion of the model. In terms of hunting or hunters, we have had a difficult time finding good data.

MR. GROSS: You mean that you are finding that the agencies have sufficient population dynamics to run your model?

MR. BELL: I stated in my presentation before we had to rely on subjective judgment in a number of areas. The managers appear to willingly make necessary judgments. They seem to feel they had enough experience behind them so that they could.

I have to agree with you very strongly, that not all the data are available. We were most fortunate in our work in Michigan, where probably more data are available than in many other states.

PROFESSOR WEEDEN: I would like to suggest my ignorance here and ask the speaker if he would comment on this.

It seems to me that at this stage of the game, if we began a system using this

type of simulator, we would find initially a very great unevenness in our management programs that would stem from two inherent unevenesses in the state of the art. One is a distinct bias in the measurement of the output—that is, what can you identify as production of game management effort?

In this case, for example, we have looked at man days and that is relatively easily measured output. However, there may be others that are as important but less distinctly measured. Therefore, that is one sort of uneveness.

There is another one which Mr. Gross just alluded to—the difficulty of getting a program going that is based on on-going standard data collection activities and I submit that there will be very few of the species or very few of the geographic areas under a management agency area of responsibility from which we could, today, extract this kind of data so that we might be able to apply the program to deer and to man days of output. We may not be able to apply the program to other species or to other sorts of output.

MR. BELL: I am not sure exactly how to answer that.

We have been restricted, of course, to looking at the output in terms of man days. Therefore, we really have not looked at a number of alternatives in that area.

In relation to the second aspect, it is my opinion that too often people will gather data before they decide what they are going to do with them and, therefore, it seems to me much more appropriate to try and develop a model, first, after looking at the whole system and regardless of the data in order to decide what data you should collect.

It seems very logical to me that the first step is trying to build a model. The second is trying to get data to fit the model and, in a sense, here, where there are more data than anywhere else, you set a precedent.

I know what we need here is a good model. We know the data we need for it. If we are going to implement it, let's go out and get the data.

THE POLITICAL ECONOMY OF WATER RESOURCES DEVELOPMENT

STEVE H. HANKE
The Johns Hopkins University, Baltimore, Maryland

Water resource development and management in the United States have created twelve thousand miles of waterways, irrigated thirty million acres of land (and drained an even larger area), provided water supplies for countless cities and industries, directed tons of concrete and earth at thousands of streams which from time to time overflow their banks and harnessed more than thirty million kilowatts of electric power capacity. The nation has spent more than 240 billion dollars (at 1970 price levels) in water resource development. More than 72 billion dollars of this amount has been spent under federal auspices, with current federal expenditures budgeted at three to four billion dollars annually (White 1969). Assuming the main objective of these federal expenditures is to contribute to the national welfare, two issues require clarification: the definition of "national welfare"; and the measurement of contributions to that welfare made by water resource development.

The Flood Control Act of 1936 suggests that the basic criterion for

evaluating water resource projects is a favorable benefit-cost ratio. The Act specifies that "the Federal government should be prepared to undertake such investments . . . if the benefits to whomsoever as they may accrue exceed the cost." Among the numerous efforts to produce effective accounting methods for recording benefits and costs are: a National Resources Planning Board Study in 1941; a series of studies by the Inter-Agency Committee on Water Resources—culminating in a handbook of practices for economic analysis of river basin projects (originally issued in 1950 and revised in 1958); a report by a panel of consultants of the Bureau of the Budget in 1961; and inquiries by both the Senate Committee on Interior and Insular Affairs, and the Senate Public Works Committee.

Most recently, the Water Resources Council has proposed "Principles and Standards for Planning Water and Related Land Resources" which attempt to improve the inclusiveness and reliability of benefit-cost practices (Federal Register 12/21/71). The Water Resources Council has provided a far more comprehensive discussion of economic evaluation issues than any federal, congressional or executive effort has heretofore produced. However, the conceptual validity and methodological feasibility of some of the new procedures are open to question. It has been observed that the application of the new proposed principles and standards would continue to lead water planners to overestimate project benefits, to underestimate their costs, and to inadequately consider environmental impacts (Cicchetti *et al.* 1972). The acceptance of the proposed procedures would continue to bias evaluation procedures in favor of development and against the preservation of environmental values.

While the design of engineering structures and benefit-cost tests to measure their performance have been emphasized, the methods used to finance projects have been largely ignored. Reimbursement practices (pricing and cost-sharing) have been separated from and inconsistent with evaluation procedures. This phenomenon has been referred to as the evaluation-reimbursement dichotomy (Krutilla 1969). Although economic evaluation is mainly concerned with the magnitude of benefits and costs while reimbursement policies follow from their incidence, it has been demonstrated that evaluation and reimbursement cannot be separated in proper economic analysis (Krutilla 1969 and Seneca 1970). Objectives and plans are not results. If reimbursement policies are not consistent with evaluation practices, *ex post* performance will not meet *ex ante* predictions (Haveman 1972).

This paper focuses on the nature, causes, consequences, and remedies for the evaluation-reimbursement dichotomy. Although these are

frequently neglected topics, they are vital to an understanding of the political economy of water resource development.

I. THE NATURE OF THE EVALUATION-REIMBURSEMENT DICHOTOMY

At the authorization stage of project approval, a benefit-cost analysis showing a benefit-cost ratio greater than one must accompany any proposed project. However, there are no reimbursement "tests" that must be met at the time of project authorization. Reimbursement is considered to be a separate issue, unrelated to project planning. Cost-sharing and pricing rules are not applied to a project until after it has been authorized and appropriations made for its construction. These policies have been developed by Congress and by administrative decisions, and are inconsistent with the evaluation procedures used to determine the economic worth of a project. (Marshall and Broussalian (1971).

The rules of cost-sharing and cost allocation determine what part of a project's cost the Federal Government will pay and what part the local beneficiaries will pay. Obviously, these rules will influence a local government's choice of projects. If, for example, the local cost-share is not the same for alternative means of accomplishing the same objective, local governments will tend to favor those alternatives requiring the lowest local contribution.

Cost allocation refers to the distribution of total cost of a multipurpose project among various purposes. The usual method for assignment of costs is the separable costs-remaining benefits method. Separable costs are the incremental costs of including a specific purpose in the project. Joint cost is the amount by which total project costs exceed the sum of all separable costs. Each project purpose is assigned a separable cost and a percentage of joint costs.

Once the costs have been allocated according to purpose, cost-sharing rules determine what share of the cost for each purpose the Federal Government will assume. Due to the ad-hoc nature of cost-sharing rules, they vary widely and are frequently internally inconsistent. The Federal Government pays for 100 percent of the construction costs on flood control and navigation projects. At the other extreme, the Federal Government does not contribute anything to the construction cost of hydroelectric power and municipal and industrial water supplies. Lying between these two extremes are a host of other arrangements for irrigation, water quality, recreation and drainage. These rules not only vary among purposes but also among agencies providing for the same purpose (Marshall and Broussalian 1971).

Current reimbursement provisions create incentives for local governments, members of Congress and federal agencies to allocate costs

so as to minimize local reimbursability. If these groups are successful in their endeavors to transfer costs to the Federal Government there are obvious payoffs: the beneficiaries receive a subsidy; their representatives receive the support of their constituents; and the agencies receive the support of their clientele in the Congress (Schultze 1969). The following arguments are intended to illuminate the undesirable side-effects associated with the separation of water resource project costs from their beneficiaries.

II.

THE CONSEQUENCES OF SEPARATING EVALUATION AND REIMBURSEMENT

The assessment of a charge for project outputs will affect the rate at which a project's services are used. Hence, the level of an output's price will affect the magnitude of a project's benefits and its evaluation. The ideal reimbursement structure would equate marginal social costs and marginal social benefits. This occurs when a product or service's price is set equal to its incremental (marginal) cost (Hanke and Davis 1971). This is the only reimbursement practice that is consistent with sound evaluation procedures.

Prices that equate the marginal social benefits and the marginal social costs of water resource projects are usually not employed (Davis and Hanke 1971 b). Water resource management has been based upon the management of supply. Supply has been regularly augmented to meet asserted "requirements" (Hanke and Boland 1971). Demand management through proper cost-sharing and pricing has not been effectively used—indeed, it is almost never employed to manage use and/or influence investment. This situation, the evaluation-reimbursement dichotomy, has led to prices that are too low and excess demands for projects' output. Since demands are viewed as "requirements," "shortages" can only be met by overdesigning and prematurely investing in facilities (Davis and Hanke 1971 b). Prices that are too low have not only induced overinvestment in water facilities, but they have also deprived water planners of valuable information that is needed to perform sound benefit-cost analyses. Since prices for water services do not reflect their value, planners have very little data to use in estimating whether a given level of service is worth its cost. The "political market" will also be distorted when water prices are too low, since political demands for subsidized products are exaggerated by the beneficiaries of those products.

Numerous examples could be used to more fully illustrate the consequences of separating evaluation and reimbursement and the resulting inappropriate pricing and cost-sharing policies that have resulted from this separation (Davis and Hanke 1971a, Davis and

Hanke 1971 b). However, the following discussion will be limited to an exposition of the perverse effects of the reimbursement practices contained in our national flood control policy.[1]

In 1936, Congress, alarmed at increasing flood losses, passed the Flood Control Act, which marked the beginning of a systematic governmental effort to reduce flood damages. The policy contained in this Act and later legislation followed the ancient pattern: dams, canals, channel improvements, dikes, and levees were to be built to control flood waters. The financing of these structures was to be carried out largely by the Federal Government with local governments making no contribution to their construction costs. In addition to these financing arrangements, federal policy has also been aimed at directly assisting states, localities and individuals to recoup large flood losses. These subsidies include income tax writeoffs and low interest, long term loans. The Federal Government also provides temporary housing, temporary mortgage and rental payments, food coupons, unemployment compensation, employment assistance, legal aid, and debris clean-up services.

Thirty years have passed since the enactment of the Flood Control Act. What have been the results? The Army Corps of Engineers and the Soil Conservation Service have invested over seven billion dollars in flood damage reduction measures. The annual expenditure is now approximately 500 million dollars and increasing. In addition, 100-150 million dollars per year is spent on disaster relief for flood victims. Yet, today floods cost the nation an average of 1 billion dollars a year, twice the 1936 figure, and losses are expected to jump to five billion dollars in the year 2020. Obviously, we are playing a losing game. We may well ask how we can get off this treadmill.

The primary reason for the increasing flood losses is the rapid development of flood-prone areas, a practice encouraged by the separation of costs from benefits. The general public bears the costs of flood protection and relief, while individuals living on flood plains receive the benefits. National flood policy should not be expressed solely in terms of the benefit-cost criteria which are used to justify the construction of public works for flood prevention. Rather, it should be formulated in terms of encouraging the rational use of flood-plain lands. This can only be achieved if incentives properly reflect the costs of locating in flood-prone areas. Incentives contained in national policy should induce public and private investment in the flood plains only if the advantages of locating there are greater than alternative sites by an amount which exceeds the expected value of flood damages

[1] For a more complete treatment of this topic and bibliographic references see (Hanke, 1972 and Davis and Hanke, 1971 b).

or the costs of preventing those damages. Present policy not only fails to consider incentives for the efficient development of flood-prone areas, but it sets up a system of subsidies which encourage the uneconomic development of flood plains.

Economic incentives must be designed to reflect the true costs and benefits of flood plain occupancy and use. Our flood policy includes a tool—Federal Flood Insurance—that is currently badly misused. In 1968 the National Flood Insurance Act was passed. This gave the Secretary of the Department of Housing and Urban Development the authority to establish and carry out a program permitting people to purchase insurance against losses resulting from physical damage or loss of real or personal property arising from floods. To qualify, local areas were required to meet certain standards with respect to land use and subdivision planning as well as building and health codes.

In this case, as with other elements of flood policy, insurance is a misnomer, since present occupants of flood plains are actually not being insured but subsidized. The original rate for a single family dwelling valued at no more than $17,500 is 40 cents per year per $100 coverage for the structure and 50 cents per year per $100 coverage for its contents. Occupants who purchased policies were paying only 20-25 percent of the true actuarial premium. But even at these subsidized rates, the insurance has not been popular. As of June 1971, only 670 communities had expressed an interest in it, and only about 75,000 policies had been written. The simple fact is that we do not subsidize this program as heavily as we do other options, such as building dams, levees, etc. To "correct" this situation, on June 26, 1972, premium rates were reduced an additional 40 percent.

Although the 1968 legislation is a step in the right direction, it should be restructured so that the costs and benefits are no longer separated. To achieve this end, flood insurance must not be left to the discretion of individual governmental units but should be mandatory for all flood-plain residents, who should pay full actuarial costs.

This arrangement would have significant advantages over current policy. Potential occupants of hazard areas would not have to know how to interpret complex hydrologic maps, understand probability statements, or any other factors regarding floods that they may now have trouble perceiving. With mandatory, full actuarial flood insurance, all this information would be nicely compressed into one index that all people are familiar with—price. This system would also guarantee that with a minimum of bureaucratic "red tape" the flood plain would be efficiently developed, since people would be allowed to freely determine whether the benefits of living and using the flood plain outweigh the costs, which include the annual insurance premi-

um accurately reflecting the private risk of living and locating in a potential disaster area.

Even when the beneficiary of the flood insurance program pays the full actuarial cost, he is paying only the private cost of insurance. The social cost—the cost to society at large for protecting him from floods—are not reflected in his premium. At present, local governments generally make no contribution to the construction of federal flood control projects. Clearly the final resting place for the social costs of any project should be with the governmental unit that it benefits. For example, if 85 percent of the incremental benefits from a large reservoir were for local flood control, then the local community should be required to pay 85 percent of the project costs. This policy change would force local governments to plan rationally for the use of flood plains. They would then be faced with the true costs of their alternatives—parks, zoning, building codes, flood warning systems, dams, and the like. Only by making changes in the incentive systems that are contained in our national flood policy can we hope to rid that policy of its perverse effects. These changes as well as those required in other water resource areas can be more effectively made if the political economy of water resource development is clearly understood.

III. THE POLITICAL ECONOMY OF WATER RESOURCES DEVELOPMENT

The political economy of water resources development is complex. Elements that explain the existence of the evaluation-reimbursement dichotomy and associated uneconomic pricing and cost-sharing procedures are many and varied. The traditional justification for the formation of public agencies and bureaus to provide water services has been the alleged failure of the private market to bring forth desired quantities of these services. The pattern of public provision by newly organized agencies is rather uniform. Public sector incentives are not automatically provided and are rarely considered when new functional areas are first engaged in. The failure to provide performance measures related to program objectives leads to several problems. Detailed regulations which specify acceptable behavior by agency personnel become numerous. "Red tape" and complex contract provisions multiply. Procedures are developed to control the purchase of supplies, long-distance communications, travel, etc. Organization charts are established and carefully monitored. Since personnel cannot be judged on the basis of their effect on output, they are controlled by the rigid specification of inputs that can be used in the provision of services. With no performance measures to monitor the efficiency with which agencies provide services, personnel quickly

begin to maximize security, avoid risks and disregard efficiency (Schultze 1969).

Over time, agencies are faced with poorer investment opportunities. In an attempt to maintain their status and size, agencies will not only attempt to bias investment criteria so as to justify inefficient investments, but they will attempt to reduce or eliminate repayment obligations (Krutilla 1969). This separation of costs from benefits is the key element that will guarantee continued support for additional projects. As it becomes harder to find efficient investments agencies will attempt to invest in projects that simply redistribute income to supporting pressure groups and away from the taxpaying public at large (Schultze 1969). The Bureau of Reclamation provides a classic example of this process. The Reclamation Act was passed in 1902 and required that irrigators repay the cost of irrigation. But since the passage of this Act, the Bureau has exhausted its economic investment opportunities (National Water Commission 1972). In an attempt to maintain support for new irrigation undertakings, the Bureau and its clientele have been successful in reducing repayment obligations; through a variety of devices, as little as seven percent of estimated real project costs has been repaid on specific projects (Davis and Hanke 1971 b).

Incentives should be employed to guide government efforts into problem areas; they should also signal agencies to reduce efforts as uneconomic investment opportunities become more numerous. This guiding function of prices and incentives occurs naturally in the private market. However, private incentives and the purgative action of bankruptcy are not automatically available in the public sector. Improved incentive structures can be devised for public agencies, but only if the public demands them.

Not only do the incentives in public water institutions currently work against the adoption of efficient investment projects, but the professional training of most water-resource agency employees also acts to bias the picture in favor of development and against preservation. The majority of employees who operate the water-resource agencies are professional engineers. Once "requirements" are forecast, the engineers' task is to design the least costly system that will meet those "requirements." An engineer is not trained to allocate resources between competing objectives, but only to accept "requirements." Therefore, he may eliminate from the scope of his analysis concern for economic demands and nonstructural alternatives, such as reimbursement policies.

Water-resource managers are not irrational. With the current set of incentives within which they operate and their professional training,

they are quite rational (Niskanen 1968). It is in their interest to promote large projects that are capital intensive. They have no "property rights" in the organizations that employ them. Therefore, their efficiency is not rewarded by an increased share of profits or by an increased salary. Their satisfaction can only be increased by pursuing nonpecuniary rather than pecuniary rewards (DeAlessi 1969). Certainly a large water resource project would classify as a nonpecuniary reward to any civil engineer who had been a part of its design and implementation.

Public managers can indulge their interests in nonpecuniary rewards because the cost to the taxpayer of exercising control over managers renders effective control extremely difficult. In most situations, the primary means of exercising control over public agencies is to move out of a particular jurisdiction in which the agency operates. This is currently happening at the state and local levels where taxpayer revolts and the movement of people from central cities to suburbs is common. At the federal level, however, the costs of opposing unwanted expenditures by relocation are rather substantial. Moreover, effective opposition to particular projects is extremely rare since the potential benefits (reduced taxes) to the opponents of projects are small relative to the costs of organizing a coalition to oppose an undertaking.

There is still some taxpayer influence that can be exerted. But it is exerted affirmatively rather than negatively (Shapiro 1969). This influence is available to organized groups of taxpayers who promote particular projects that increase their wealth by increasing their benefits and shifting costs to others. The promotion of programs by entering the log-rolling process is virtually the only way taxpayers are able to increase their wealth and maintain parity with other claimants of the public's purse. Such promotion also aids public managers in achieving their objectives.

Economists have not sat idly by viewing this log-rolling process. They have expended a great deal of time and energy criticizing the evaluation methodologies used by water-resource agencies. But, for the most part, economists have failed to attack the evaluation-reimbursement dichotomy. Their criticism of evaluation practices has no doubt had a beneficial impact on the procedures that are used. However, these changes have had little effect on the relationship between original project plans and the final results obtained from investments in water resources. No doubt, the economists have run into a diminishing marginal efficiency of investment schedule in regard to their criticisms of benefit-cost analysis. It is time that they redirect their attention to the issues of pricing and cost-sharing.

Favorable investment results can only be obtained if benefit-cost analysis and pricing policies are consistent.

IV. CONCLUSIONS

Evaluation and pricing should not be separated in a proper economic analysis. The only pricing rule that is consistent with sound benefit-cost procedures is one in which the price of a project's output is equal to its incremental cost; project beneficiaries should pay for the incremental cost of a project's output. Under these conditions, the benefits that are estimated in the evaluation process will be realized. However, if the prices charged for a project's output exceed the incremental cost of that output, the facility will be underutilized and benefits will be less than those projected in the original benefit-cost analysis. If prices are less than the appropriate incremental cost, benefits will again be less than those projected in the benefit-cost analysis. In both of these latter cases, the *ex post* benefits will be less than the *ex ante* benefits and original objectives will not be achieved.

Although the issues of pricing and cost sharing have been ignored in the past, most recently by the Water Resources Council, they have been brought to the attention of the public by the National Water Commission. Established in 1968 to review and make recommendations on a broad spectrum of water-resource problems and policies, the National Water Commission has concluded that present cost-sharing policies are grossly inconsistent and lead to inefficiencies and inequities. Based upon the principles enunciated above, the Commission has recommended that

> "insofar as administratively feasible, the users of project services should bear appropriate shares of development and operating costs through systems of pricing or beneficiary charges."[2]

Given the nature of water resource agencies, the bureaucrats who operate them, the beneficiaries of projects, and the politicians who represent them, one cannot expect a change to occur simply because the National Water Commission has emphasized the need. If this were the case, benefit-cost analysis practiced by the agencies would not continue to be out of step with the consensus of professional economic opinion. The recommended charges in reimbursement policies will not occur by simple administrative fiat, since they are, to some extent, in conflict with the American political institutions that draw their vitality from filling local needs. What is ultimately needed is a concentrated effort by those interested in efficiency in government and

[2] National Water Commission, *Proposed Report of the National Water Commission*, National Water Commission, Arlington, Virginia, 1972, p. 14, 23.

environmental values to increase the awareness of the public to the processes that generate the proliferation of water resource projects, and their unwanted side-effects. It is only through this type of action that changes can be brought about. If they are, the desires of an increasingly complex society can be more effectively met.

LITERATURE CITED

Cicchetti, C., R. K. Davis, S. H. Hanke, R. H. Haveman, and J. L. Knetsch.
1972. "Benefits or costs? an assessment of the water resources council's proposed principles and standards." Department of Geography and Environmental Engineering, The Johns Hopkins University, Baltimore, Md.

Davis, R. K., and S. H. Hanke.
1971a. Planning and management of water resources in metropolitan environments, The Natural Resources Policy Center, George Washington University, Washington, D.C.

———.
1971b. Pricing and efficiency in water resource management. National Technical Information Service, Springfield, Va.

DeAlessi, L.
1969. Implications of property rights for government investment choices. American Economic Review, 59 (March).

Federal Register.
1971. December 21.

Hanke. S. H.
1972. Flood losses—will they ever stop. Jour. of Soil and Water Conservation, 27 (November-December).

———, and J. Boland.
1971. Water requirements or water demands? Journal American Water Works Association, 63 (November).

Hanke, S. H., and R. K. Davis.
1971. "Demand management through responsive pricing," *Journal of American Water Works Association*, 63 (September), 555-560.

Haveman, Robert H.
1972. The economic performance of public investments: an ex post evaluation of water resource investments, The Johns Hopkins Press, Baltimore.

Krutilla, J. V.
1969. Efficiency goals, market failure, and the substitution of public for private action, The Analysis and Evaluation of Public Expenditures: The PPB System. Joint Economic Committee, 91st Congress, 1st Session, USGPO, Washington, D.C.

Marshall, H. E., and V. L. Broussalian.
1971. Federal cost-sharing policies for water resources. National Bureau of Standards Report 10666, U.S. Department of Commerce, Washington, D.C.

National Water Commission.
1972. Proposed report of the national water commission, National Water Commission, Arlington, Virginia. November.

Niskanen, W.
1968. Nonmarket decision making: the peculiar economics of bureaucracy, American Economic Review, 58 (May).

Schultze, C. L.
1969. The role of incentives, penalties, and rewards in attaining effective policy. The Analysis and Evaluation of Public Expenditures: The PPB System, Joint Economic Committee, 91st Congress, 1st Session, USGPO, Washington, D.C.

Seneca, J.
1970. The welfare effects of zero pricing of public goods. Public Choice, 8.

Shapiro, D. L.
1971. Pressure groups and public investment decisions: a note. Public Choice, 10 (Spring).

White, G. F.
1969. Strategies of American Water Management. The University of Michigan Press, Ann Arbor.

DISCUSSION

PROFESSOR WEEDEN: This paper is open for discussion.

Somehow I think that we have had a bomb dropped on us. I am reminded, vaguely at least, of a well-known English writer who wrote something called a modest proposal.

MR. ROBERT D. CURTIS: One of my first jobs was on water resource projects in the State of Arizona a number of years ago. I am no longer directly involved with it but the people who work for me are.

I was hopeful, when I read the title of your paper, that you would give me a good answer as to how to deal with politics and economics in the water resource field. However, I don't think you have.

Here I have reference to the National Water Commission Report, which is quite a voluminous report. What is your impression of the recommendation insofar as the discount rate is concerned? We have had several figures talked about, even up as high as 10 percent, as recommended by some economists and environmentalists, and also 7.5 percent by the Water Resource Council and the Commission report.

DR. HANKE: If you did not get my message, let me repeat it and then I will get into the discount rate.

What I am simply saying is that the only way that you can minimize political influence on these projects and eliminate the pork barrel is to merge benefit-cost analysis and reimbursement practices and make them consistent. You have to price out projects in such a way that you equate the price with the marginal cost of providing the service.

As long as these are separated, benefit-cost analysis will continue to be a fraud and you will continue to have the log-rolling and pork barrel activities we have and there is absolutely no way to have original project plans met if these two aspects are separated.

You cannot separate the pricing issue from the evaluation. In other words, if you are subsidizing the project, then the political market is completely biased in favor of these projects. You get tremendous local support, as you know, if the locals are being subsidized and are not paying for the resources that they get.

Now, as to the discount rate, the Water Resources Council and the National Water Commission have proposed that we switch philosophy and move to what is referred to as the opportunity cost of capital. What this means, very simply, is that there is a dominant view among professional economists that we build projects with resources that are generated through taxes. These taxes displace private consumption and private investment and these private investment expenditures and consumption expenditures yield a rate of return. This is about 10 to 12 percent, depending upon whose estimate you look at.

In other words, private consumption and private investment earn that 10 to 12 percent; so if we are funneling resources into the public sector and using a discount rate, as we do now, of roughly 5 percent, we are taking resources out of high-yield uses and putting them in low-yield uses and so we are wasting resources. This is inefficient and this is why economists want to move to the opportunity cost approach. I believe this step has been taken by both the Water Resources Council and the National Water Commission. I wholeheartedly applaud the move.

Another implication of the use of the low discount rate is obviously that the public sector of government is becoming bigger and bigger if the interest rate that they use is lower than the opportunity cost of the private expenditure.

MR. BRENT BLACKWELDER: Steve, you mentioned that all the studies of water development indicate that they have not come up to expectations as yet. In the last several weeks, the Corps of Engineers has been telling the Appropriations Committee that their projects have been producing benefits far in excess of their cost. What I am trying to say is that these review committees are actually being convinced that these projects are paying off and that they are living far in excess of their cost.

What kind of concrete evidence do we have to the extent of studies that we can cite to show that this is indeed not the case?

DR. HANKE: Let me make a general comment before I give a specific reference.

Most of these alleged benefits they are talking about are pure transfers and they are not really benefits. The gentleman from Arizona, for example, indicated he had been involved in project analysis and many of the project alleged benefits, in Arizona of course, come at the cost of the former cotton growers in the Southeast.

Therefore, you are getting pure transfers—a local benefit in Arizona generating a local cost in some other areas of the Southeast. Therefore, you have a transfer netting to zero in terms of real economic benefits.

Therefore, if you will look at their calculations, they are somewhat of a mystery as to how they are calculated. I would be willing to guess they would be largely made up of pure transfers.

The most thorough and complete job of evaluation has been done in a book authored by Robert Haveman, published for Resources for the Future, in which he looks at several hydro projects, navigation projects, flood control projects, and goes through a very systematic and careful ex-post evaluation. This is the 1972 publication and it is the most recent and thorough one I have seen.

Now, let me discuss this matter of flooding.

Around 50 percent of the benefits of these projects are from anticipated movements of people onto flood plains after projects are constructed, and again we are talking about transfers and not real benefits. You are building a project and have the benefits that you are going to get from the project induced by the fact that people are moving out of other locations onto the flood plain. Therefore, again, you have this transfer kind of effect.

I should also add that there are tremendous incentives to move onto the flood plain and this problem will continue. Flood benefits from projects as they are now calculated will continue to increase to justify more and more projects, because with current changes in flood insurance policy as well as other subsidies, we have completely socialized the risk of living there. We are pushing people onto the flood plain.

One has to look at all the incentives involved in relation to policy before you can make any statements about benefits from these projects.

PROFESSOR WEEDEN: This presentation has certainly stimulated a good deal of thinking on the part of the audience and I thank you very much.

DEMAND ESTIMATION IN PLANNING FOR INTENSIVE RESOURCE MANAGEMENT: DEER AND MOOSE HUNTING IN MANITOBA

R. E. CAPEL,[1] AND R. K. PANDEY[2]
Department of Agricultural Economics, University of Manitoba, Winnipeg, Manitoba, Canada

Many wild species are of value to man for ecological, commercial, scientific, and recreational reasons. At the same time, many beneficial species are threatened by loss of habitat and/or overhunting. The usual solution is to protect them, but this requires diversion of resources from other uses. It is valid to ask what level of expenditures and opportunity costs can be justified in terms of increased wildlife benefits. There are really two parts to the question. First, how can we obtain maximum wildlife benefits per dollar of direct and opportunity cost? Second, what is the proper scope or extent of protection activities?

These questions can be tackled within a benefit-cost framework. Benefits and costs could be defined and estimated as functions of

[1]Associate professor.
[2]Graduate assistant.

alternative populations of wild species maintained in specified locations. A plan could then be developed to maximize net benefits to man from the species included in the analysis.

The present study deals with only a very small portion of the total problem. It is concerned with estimating benefits accruing to hunters, and more specifically, to deer and moose hunters in Manitoba. In Manitoba, recreational hunting is a major source of wildlife benefits particularly in areas south of latitude 52°. Many species are hunted. In 1970, about 51 thousand game bird licenses were sold, for a license revenue of about 150 thousand dollars and about 47 thousand big game licences were sold, for a revenue of about 450 thousand dollars. Approximately 80 percent of the big game licences were for deer hunting and 15 percent were for moose hunting (Manitoba Department of Mines, Resources, and Environmental Management 1971).

The Manitoba population is heavily concentrated in the southern part of the Province, particularly in Winnipeg (residence of about half the Manitoba population of about one million). This results in heavy hunting pressure in southeastern and south central portions of the Province, and a felt need to protect habitat and prevent overhunting. Ideally, such protection should be pursued to that point which would maximize net benefits from wildlife.

In view of these considerations, the present study has the following objectives:

1. To obtain estimates of demand for deer and moose hunting in selected parts of Manitoba, with emphasis on the heavily hunted areas,
2. To measure benefits from hunting deer and moose, and
3. To develop a method for forecasting future levels of demand for and benefits of hunting these species.

CONCEPTUAL FRAMEWORK, PREVIOUS WORK

Estimating Benefits: Appropriate methods for measuring benefits differ according to the type of benefit in question. Benefits accrue to various groups—to the nation, the province, the locality, hunters, and other interest groups. From the national, provincial, and local points of view, benefits consist mainly of net increases in income and employment, favorable redistributions of same, net intangible benefits, and, where applicable, net revenues from licences. Hunters benefit as consumers. Outfitters benefit in terms of sales and profits. In other words, different types and magnitudes of benefits accrue to different groups.

In order to estimate benefits it must be possible to define a unit for measuring the use in question. Some accepted units are: for commer-

cial use: number of animals taken; for viewing and hunting: the visitor day and the hunter day, respectively.[3] Benefits are estimated by attaching economic values to units of use. Appropriate methods for doing this will be discussed later.

Demand Analysis: Procedures for estimating most types of benefit begin with making estimates of demand. "Demand" refers to a mathematical function according to which number of units consumed by specified groups of people per unit of time depends upon specified causal factors. These factors usually include population, price (or, for goods like hunting, cost and accessibility), quality, prices and qualities of related goods, incomes, and tastes. According to the approach taken in this study, and discussed more fully later in connection with "consumers' surplus," the amount of benefits accruing to hunters depends on the shape of the demand function.

However, estimating hunter benefit is by no means the only reason for estimating demand. Demand estimates indicate which factors influence participation in hunting, and provide a means for forecasting future hunting pressure and benefits, depending on assumptions about the causal factors—population, accessibility, quality of hunting, etc. Therefore, demand estimates can be a useful input in planning: (a) to obtain appropriate levels of hunter use and benefits, and to spread hunting pressures suitably over available areas and seasons, (b) to influence and channel hunters' expenditures so as to stimulate regional development and to encourage desired redistributions of income, and (c) to obtain a fair distribution of participation, and to ensure there is no class of people who are excluded due to poverty or inaccessibility of hunting.

Previous Studies: Although the value of demand analysis has been amply proven in other fields, very few studies have been made of the demand for hunting. There are, however, numerous investigations of outdoor recreation which have some relevance to hunting. These studies can be placed in two categories according to whether they deal with: (a) participation of the population at large without reference to the site of recreation, or (b) visitation at specified sites. The studies which did not have a site orientation have, so far, failed to reveal any very strong correlations between participation, socioeconomic characteristics of recreationists, and overall accessibility of recreation (Mueller and Guerin 1962; Cicchetti, Seneca, and Davidson 1969; and Kalter and Gosse 1969). By contrast, site-oriented studies have shown strong correlations between participation and various explanatory variables. Early site-oriented studies (Trice and

[3]No satisfactory units seem to be available at present for measuring use in scientific study or meeting option demand.

Wood 1958; Clawson 1959; Wood 1961; and Ullman and Volk 1962) followed Hotelling's suggestion that concentric zones be delineated around the site and demand be estimated by plotting visitation per capita of the zone against distance from the site (Hotelling 1947). In later studies, income and other socio-economic factors were also found to influence visitation though to a much smaller extent than accessibility (Boyet and Tolley 1966; Merewitz 1966; Stevens 1966; Stoevener and Brown 1967; Johnston and Pankey 1968; and Pearse 1968) Cesario showed also that visitation was related to measures of attractiveness and of competing sites (Cesario 1966). Later workers, using similar variables, obtained better results by including several sites and several origins of visitors, in gravity models (Wolfe 1966; Chubb 1967; Grubb and Goodwin 1968; and Cheung 1972).

In order to convert such demand estimates into monetary terms, distance must be translated into dollars. In all the studies mentioned, this has been done by multiplying distance by travel cost per mile.

An alternative to this "travel cost" method, is to interview recreationists and ask them how much they would be willing to pay as a maximum (and/or how far they would be willing to drive) if they had to in order to continue to use the hunting area (Davis 1963; Knetsch and Davis 1966; and Pattison and Phillips 1971). This method has been used by relatively few authors, because most workers have felt that unknown and possibly large biases could easily occur in the interview responses.

This previous work was considered in planning the present study, since hunting is a form of outdoor recreation, and our data (discussed later) were in an appropriate form for use with a gravity model. In addition, we were able to use a variable for measuring attractiveness of hunting areas, namely hunters' success. Data were not readily obtainable on income and other socio-economic variables. These were omitted because it was judged that the cost of including them would not have been justified. We also used a travel cost rather than a willingness to pay approach.

Consumers' Surplus: In order to proceed from an estimate of demand to an estimate of benefits, some further concepts are needed. Among a few alternatives, the consumers' surplus approach is generally preferred by economists.[4]

The concept dates from Dupuit (Dupuit 1844). Since then, various meanings, or types of surplus have been discussed (Marshall 1920; Hicks 1943; and Winch 1965). The present opinion is that the surplus to be estimated is equal to the total revenue which could be collected

[4]Other concepts which have been used include market value of game caught, gross expenditures of hunters, opportunity cost of time spent hunting, and cost of providing game.

by a perfectly discriminating seller of the good in question. This idea is based on the view that a buyer obtains an amount of satisfaction at least equal to, and in most cases more than, that which he could obtain from spending the purchase price of the good on the best available substitute. Assume that each consumer could be forced—by a perfectly discriminating monopolist—to pay so much for a good that any further increase in its price would induce him to buy something else instead. If this were the case, consumers' excess expenditure beyond that which would be necessary in a competitive market would measure net satisfaction or consumers' surplus. Figure 1 illustrates the concept. Price is on the vertical axis, quantity sold per time period on the horizontal axis. O P is the competitive market price. O M is the quantity purchased by consumers at this price. D E is the demand function. The hypothetical discriminating monopolist would bargain individually and secretly with each potential buyer and establish the most the buyer would pay.

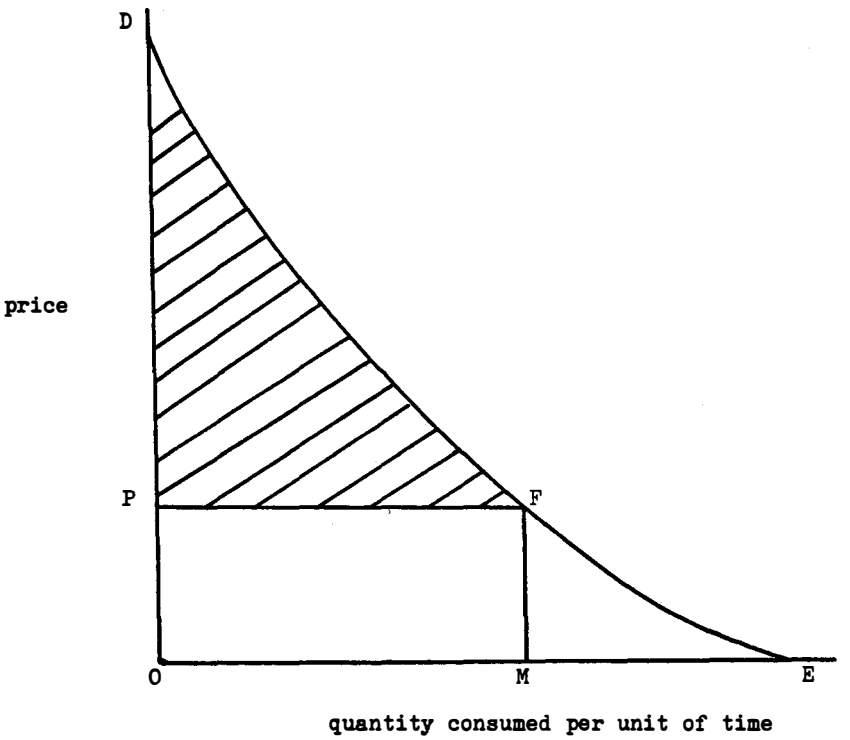


Figure 1.—Consumers' Surplus

Results could be displayed in an array showing units sold and corresponding prices. One unit would have been sold at price O D. Other units would have been sold at lower prices, as shown by the shape of the demand function, and the lowest priced unit would have been sold at price O P. The discriminating monopolist would have obtained a total revenue of O M F D. From this would be substracted the competitive seller's revenue of O M F P, leaving a consumers' surplus of P F D, the shaded area in Figure 1. In the case of hunting, O P is the licence fee (if any), allocated among hunting days, plus the admission fee (if any), per day, at the site. As mentioned, in cases of non-marketed goods, the demand function D E has been estimated by travel cost and willingness to pay methods, and the travel cost method is used to estimate demand in the present study.

PROCEDURES AND RESULTS

Data were obtained from questionnaires sent annually in 1965 through 1969 by the Manitoba Government Wildlife Branch to randomly selected 10 percent samples of Manitoba resident deer and moose hunters. Questionnaire response rates exceeded 85 percent and, for purposes of this study, the responses are considered to be adequately representative of all Manitoba hunters. The questionnaires showed place of residence of hunters, and dealt with areas where hunting was done, dates of hunting, and whether or not, and where animals were bagged.

Summaries of the results were made by the Wildlife Branch, showing hunting pressure and harvest, by Manitoba hunters, and by Winnipeg hunters, in the various hunting areas. The numbering and boundaries of hunting areas were changed during the 1965-1969 period. However, for this study, it was possible to obtain data which correspond adequately to the 22 areas shown in Figure 2.

Analyses of these data were made using single equation, least squares, regression. Based on previous workers' findings, it was hypothesized that number of hunter days spent in an area would depend on distance to the area and anticipated quality of hunting, which was measured by success (harvest divided by hunter days) lagged one year. The generalized model is as follows:

$$V_{ijt} = (D_{ij}, S_{jt-1}) \qquad (1)$$

where:

V_{ijt} = number of hunter days in year t spent in area j by residents of town i;

D_{ij} = round-trip distance between town i and hunting area j, and

S_{jt-1} = success (harvest divided by hunter days) in year t-1 in area j.

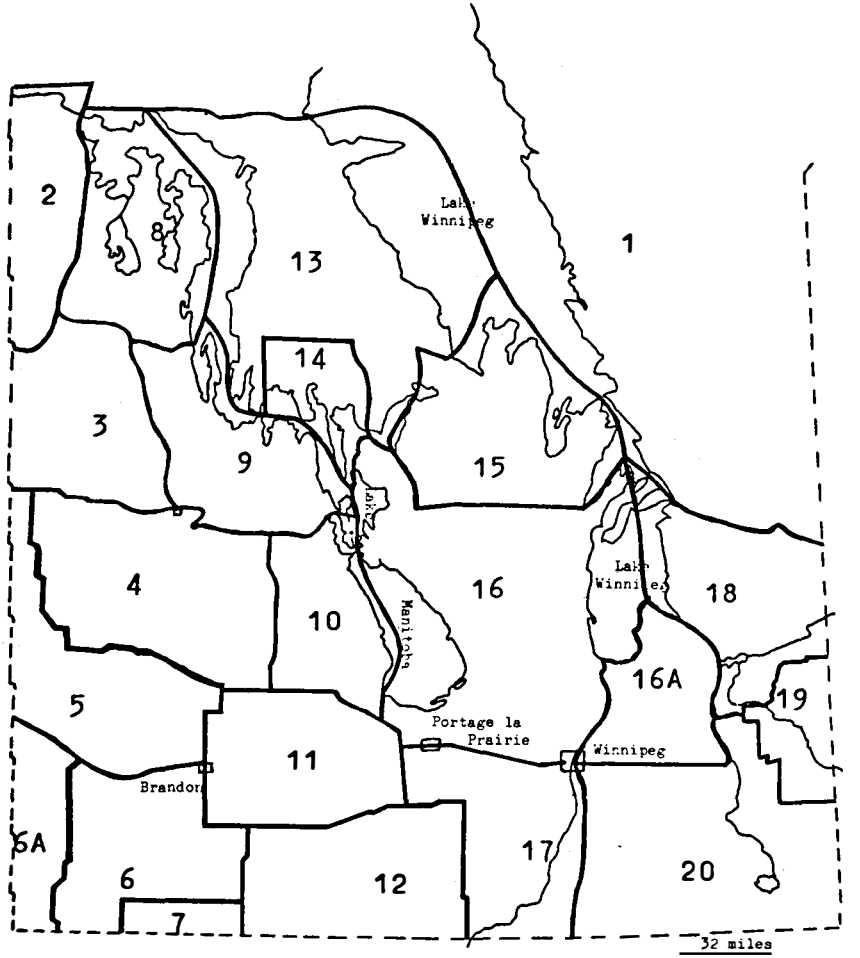


Figure 2.—Manitoba, Hunting Areas

In selecting an estimating form of the equation there was no theoretical basis for preferring any particular form, so trials were made with arithmetic and logarithmic forms. The logarithmic form gave the best least squares fit. Results of using this form to analyse data of Winnipeg hunters are shown in Table 1.

The coefficients for distance are negative in all cases and statistically significant in six out of the seven equations. Deer hunting pressure is positively related to success in the preceding year in all equa-

tions and all the coefficients are significant. However, with moose, the coefficients for success differ widely among years and are not statis-

TABLE 1. DEMAND FOR DEER AND MOOSE HUNTING IN MANITOBA BY WINNIPEG RESIDENTS[1]

Type of Hunting		Constant log C_0	Distance C_1	Success[2] C_2	R^2
Deer[3]	1966	3.87	−1.37***	1.09***	0.65
			(0.29)[4]	(0.40)	
	1967	4.54	−1.39***	0.31**	0.64
			(0.27)	(0.16)	
	1968	2.19	−1.42***	1.85***	0.65
			(0.31)	(0.61)	
	1969	2.65	−1.62***	1.89***	0.67
			(0.31)	(0.54)	
Moose	1966	4.21	−1.59**	0.96	0.54
			(0.57)	(0.83)	
	1967	5.17	−0.95	−0.09	0.27
			(0.62)	(0.41)	
	1968	5.97	−0.85**	−0.59	0.44
			(0.33)	(0.54)	
	1969[5]				

[1]Using the equation: $\log V = \log C_0 + C_1 \log D + C_2 \log S$.
[2]Variable used is Success t-1 $\times 10^3$.
[3]Number of observations in each equation: deer 22: moose 12.
[4]Standard errors shown in parentheses.
[5]Data not available.
**Significant at the 5 percent level.
***Significant at the 1 percent level.

tically significant. Another finding, not shown in the table, was that distance contributed more to regression than did success. In the deer hunting analysis, for example, using distance alone, R^2 ranged from 0.57 to 0.45 over the four years, while with success alone it ranged from 0.25 to 0.12.

The above results are interpreted by us as follows. Firstly, if all other things are equal, people prefer to hunt deer and moose in nearby rather than more distant areas. Secondly, deer hunters, but not moose hunters, prefer areas where success in the previous year was high compared to other areas. There are several possible reasons why moose hunters were not shown to react similarly to success. Bag restrictions which varied among areas could have had effects not accounted for in the analysis. Also, it is known that many people inquire at the Wildlife Branch about moose populations before deciding whether or where to hunt. Results of these inquiries could affect hunting pressures.

APPLICATIONS

Projecting future hunting pressure in an area. Future hunting pressure in an area, originating in Winnipeg, may be projected using the model and estimated coefficients. Appropriate assumptions are made about distance and success. Selection of valid coefficients is partly a matter of judgment. In this case, it is suggested that an average of the 1966, 68, and 69 values be used. The estimate obtained

using these assumptions and coefficients is then adjusted for population change and for a trend in per capita participation. An example follows to illustrate the suggested procedure:

Problem: project hunting pressure from Winnipeg in Manitoba Hunting Area 11 in 1975.

Assumptions: round-trip distance from Winnipeg = 174 miles; success = 0.2 (average 1965-69 for the area is 0.204), and coefficients (averages of 1966, 1968, 1969, as shown in Table 1): log C_0 = 2.90, C_1 = −1.47, C_2 = 1.61.

Step 1: Estimated hunting pressure in base year, 1968: log V = 2.90 − 1.47 log 174 + 1.61 log 200 = 3.311. V = 2,046 hunter days.

Step 2: Adjustment for population change:

Assumptions: Winnipeg population in 1968 = 523,000; in 1975 = 590,000. Adjustment factor $= \frac{590}{523}$

Step 3: Adjustment for trend in per capita participation: Rate of increase = 1.5 percent per year.[5] Adjustment factor = $(1.015)^7$

Step 4: Projected hunting pressure in Area 11 in 1975, due to Winnipeg hunters $= 2{,}046 \times \frac{590}{523} \times (1.015)^7 = 2{,}561$ hunter days.[6]

To project hunting pressure from other origins, there are at least two alternative methods. Both require projections of population by geographic region, e.g., census divisions. Method (1) is more precise, but more costly. It involves estimating separate demands for the various regions, projecting visitation from each region, and summing the projections. Method (2) involves projecting non-Winnipeg hunting pressure using the assumption that there is a fixed ratio between the per capita participation rates of Winnipeg and non-Winnipeg hunters. The decision as to what constitutes the appropriate region of origin of "non-Winnipeg" hunters is arbitrary. The previous example is used to illustrate method (2).

Step 1: Hunter days per thousand of population:[7]

$$\text{Winnipeg, 1968} = \frac{2{,}414}{523} = 4.62\,; \quad \text{non-Winnipeg, 1968} = \frac{9{,}320}{201} = 46.37.$$

[5]This trend was estimated by least squares regression using the equation: log V = $C_0 + C_1T$ where: V = hunter days per capita of the Manitoba population, T = time (12 observations, 1959-1970).

[6]For confidence intervals, see J. Johnston, *Econometric Methods*, New York: McGraw-Hill, first edition 1963, pp. 131-133.

[7]1968 hunter days are actual, 1975 are projected. The "non-Winnipeg" region includes Census Divisions 2, 3, 4, 6, 7, 8, 10 and 11. Population of this region in 1975 is projected to be 190,000 (projected by summing extrapolations of trends for individual census divisions).

$$\text{Winnipeg, 1975} = \frac{2{,}561}{590} = 4.34 \text{ days per thousand.}$$

Step 2: Projected visitation:

$$\text{non-Winnipeg, 1975} = 4.34 \times \frac{46.37}{4.62} \times 190 = 8{,}277 \text{ days.}$$

PROJECTING BENEFITS

As discussed earlier, benefits accruing to hunters may be estimated as consumers' surplus, equal to the area under the demand curve. Using the example given above, the estimate for Winnipeg hunters is as follows:

The demand function is: $V = C_0 D^{c1} S^{c2}$,

where the variables and parameters are defined as in equation (1) and Table 1, footnote 1 above.

The area A under the curve, expressed in terms of miles, between the limits a and b is:

$$A = \int_a^b C_0 D^{c1} S^{c2} \cdot d\,D$$

$$= C_0 S^{c2} \left[\frac{1}{C_1 + 1} D^{c1+1} \right]_a^b$$

$$= \frac{C_0 S^{c2}}{C_1 + 1} \left[b^{c1+1} - a^{c1+1} \right]$$

Since the curve is asymptotic to the axes, $A = \infty$ unless $a > 0$ and $b < \infty$. For the present example the limits arbitrarily selected are a = round-trip distance from Winnipeg to Area 11, = 174 miles, and b = a + 200 miles = 374 miles. The area is therefore estimated as:

$$A = \frac{-(\text{antilog } 2.9)\ 200^{1.61}}{0.47} \left(\frac{1}{374^{0.47}} + \frac{1}{174^{0.47}} \right) (0.015)^7 \frac{590}{523}$$

= 286,473 miles = 112 miles per hunter day

= $4.48 per hunter day, assuming 1 mile of trave costs 4¢ per hunter.

Benefits accruing to non-Winnipeg hunters are estimated similarly. It is assumed that the demand has the same form as that of Winnipeg hunters and that Area 11 is 80 miles distant from non-Winnipeg hunters' residences (round-trip distance).

C_0 for non-Winnipeg hunters' demand is estimated as follows:

$V = C_0 D^{c1} S^{c2}$

Substituting: $8,277 = C_0\ 80^{-1.47} \cdot 200^{1.61}$,

$C_0 = 909.5$

Benefits to non-Winnipeg hunters:

$$A = -\frac{909.5 \cdot 200^{1.61}}{0.47}\ \frac{1}{280^{0.47}} + \frac{1}{80^{0.47}}$$

$= 1{,}131{,}044$ miles $= 137$ miles per hunter day

$= \$5.48$ per hunter day, assuming 1 mile of travel costs 4¢ per hunter.

EVALUATION OF HUNTER REGULATION AND GAME MANAGEMENT

(i) Impact of and factors affecting success:

The coefficient for success can be used in estimating the impact of changes in success upon visitation and upon benefits. To illustrate this, the reader may wish to rework the examples given above using alternative values for success.

To investigate factors influencing success, a further analysis was done. It was hypothesized that success depends on the ratio of deer population to hunting pressure.

Information was not available on deer populations. However, deer counts taken by air each spring for seven areas and four years, *i.e.*, 28 observations were made available to us by the Manitoba Department of Mines, Resources and Environmental Management. Regressions were run of success (dependent) upon deer count divided by hunting pressure and dummy variables for areas and years. The dummy variables were included on the basis of the hypothesis that the percentage of deer counted varied widely among areas and years, and that this affected success. If other unmeasured factors associated with areas and years also affected success, their effects would also be accounted for by the dummy variables. The coefficient for deer count divided by hunting pressure without inclusion of dummy variables was 0.003 (not significant) and R^2 was 0.06. When the nine dummy variables were included, the coefficient was 0.006 (significant at the 10 percent level) and R^2 was 0.88.[8] As well as confirming the obvious —that with given hunting pressure, success is greater if there are more deer—this also supports the view that these deer counts are useable as indicators of trends in population. If further research

[8]For area game management purposes, the following regression results are also of interest. The area and year dummy variables were included, but are not shown below.

$$X_1 = -5.52 + \underset{(0.03)}{0.16X_2}^{***} + \underset{(0.04)}{0.04X_3},$$

where:

X_1 = number of deer harvested in an area;

X_2 = number of hunter days spent in the area; and

X_3 = number of deer counted in the area in the previous spring.

could determine the percentage of deer counted, it would be possible to quantify the effect of deer population upon success.

(ii) Effects of length and time of open season:

(a) Analysis of time-series data: Information was available on licences purchased and hunter days per capita of the Manitoba population, as well as length of season in days, estimated as a weighted average for all hunting areas, annually for the period 1959-1970 (Manitoba Department of Mines, Resources and Environmental Management, annual and 1971). Each of these variables increased during the period, including licenses per capita at a rate of one percent per year, and hunter days per capita at a rate of 1.5 percent per year. Positive correlations were found between licenses per capita and length of season, and between hunter days and season. However, because there are fairly smooth trends, rather than fluctuations in the three variables, it is risky to infer that licenses or hunter days will in future respond or, at least, will respond quickly, if changes are made in the length of season.

(b) Analysis of cross-sectional data: The regression used to derive the results shown in Table 1, using data on Winnipeg hunters in 1966-1969, with a separate equation for each year, was modified by adding dummy variables for different hunting seasons. Upon first inspection, the results seemed to suggest that Winnipeg hunters have a slight preference for areas which are open during the second half of the hunting season (which usually extends from mid October to the end of November). However, the various areas were open in approximately the same sequence each year, *i.e.*, seasons were not randomized among areas. For this reason the observed effect could as well be due to some other characteristics of the areas, not included in the analysis. The use of dummy variables would however be valid for investigating this problem in situations where seasons are randomized among hunting areas.

CONCLUSIONS AND IMPLICATIONS

Demand analysis has many applications in planning and evaluating wildlife programs, though its potential cannot be realized without related studies of factors affecting game populations. The particular models discussed here, although useful, need improvements which should be the subject of future research. Predictive power should be improved and other causal factors investigated, including accessibility factors other than distance, bag restrictions, seasons, area- and season-specific licenses, advertising, and official advice to hunters about expected relative success by areas. More research is also needed to measure game populations and to study relationships between populations, hunting pressures, and success.

However, in spite of limitations, economic analysis is of great value. It can help answer many questions about factors influencing hunting pressure, and about benefits and costs associated with wildlife. For example, demand studies could indicate how hunting pressures would change in surrounding areas if an area were closed in order to protect game. Economic analysis could assist in evaluating alternative methods for dispersing hunters away from overhunted areas. Policies for dispersion of hunting pressure could be evaluated against policies for creating and preserving habitat in heavily hunted areas. These and other unrealized potentials exist for applying economic, and particularly demand, analysis to problems in planning for intensive wildlife resource management.

ACKNOWLEDGMENTS

We wish to express our appreciation to E. F. Bossenmaier, R. C. Goulden and J. L. Howard of the Manitoba Department of Mines, Resources and Environmental Management for providing data essential for the study and for contributing many useful ideas and suggestions. We also wish to thank J. A. Gray, C. F. Framingham and Sol Sinclair, of the University of Manitoba, for valuable advice and criticism of the manuscript. We, of course, accept full responsibility for the analysis and for opinions expressed in the paper.

LITERATURE CITED

Boyet, W. E. and G. S. Tolley
1966. Recreation projection based on demand analysis. J. Farm Econ. 48, No. 4 (November):984-1001.

Cesario, F. J.
1966. A dynamic model of the economy of the Susquehanna River Basin. Columbus, Ohio: Batelle Memorial Institute.

Cheung, H. K.
1972. A day-use park visitation model. Ottawa: Department of Indian Affairs and Northern Development, Canadian Outdoor Recreation Demand Technical Note No. 1.

Chubb, M.
1967. Outdoor recreation planning in Michigan by a systems analysis approach, part III, Lansing, Michigan: Department of Commerce, Technical Report No. 12.

Cicchetti, C. J., J. J. Seneca and P. Davidson.
1969. The demand and supply of outdoor recreation. Bureau of Economic Research, Rutgers, N. J.

Clawson, M.
1959. Methods of measuring the demand for and value of outdoor recreation, Washington, D. C.: Resources for the Future, Reprint No. 10.

Davis, R. K.
1961. The value of outdoor recreation: an economic study of the Maine Woods. Harvard University, unpublished Ph.D. dissertation.

Dupuit, J.
1844. De la mesure de l'utilité des travaux publics, Annales des Ponts et Chaussés, VIII.

Grubb, H. W. and J. T. Goodwin.
1968. Economic evaluation of water-oriented recreation in the preliminary Texas Water Plan. Austin, Texas: Texas Water Development Board, Report No. 84.

Hicks, J. R.
1943. The four consumer's surpluses. Review of Economic Studies 11:31-41.

Hotelling, H.
1947. Letter to R. A. Prewitt, Director of U. S. National Parks Service. *In* The economics of public recreation—an economic survey of the monetary evaluation of recreation in the National Parks, Washington, D. C.: National Parks Service, 1949.

Johnston, W. E. and V. S. Pankey
1968. Some considerations affecting empirical studies of recreation use. American J. Agricultural Econ. 50, No. 5 (December) :1739-1744.
Kalter, R. J. and L. E. Gosse.
1969. Outdoor recreation in New York State: projections of demand, economic value, and pricing effects for the period 1970-1985, Ithaca, New York: Cornell University, Special Series No. 5.
Knetsch, J. L. and R. K. Davis.
1966. Comparison of methods for recreation evaluation. *In* Water research. *Edited by* A. V. Kneese and S. C. Smith, Baltimore: Johns Hopkins for Resources for the Future, pp. 125-142.
Manitoba, Department of Mines, Resources and Environmental Management.
annual Game bird and big game seasons, Winnipeg, Manitoba.
1971. Sales of hunting and angling licenses, Winnipeg, Manitoba.
Marshall, A.
1920. Principles of economics, 8th ed. reprinted 1961, London: MacMillan.
Merewitz, L.
1966. Recreational benefits of water resource development. Water Resources Research II, No. 4:625-640.
Muller, E. and G. Guerin.
1962. Participation in outdoor recreation: factors affecting demand among American adults. Outdoor Recreation Resources Review Commission Study Report 20, Washington, D. C.: Government Printing Office.
Pattison, W. and W. E. Phillips
1971. Economic evaluation of big game hunting: an Alberta case study. Canadian J. Agricultural Econ. 19, No. 2 (October) :72-85.
Pearse, P. H.
1968. A new approach to the evaluation of non-priced recreational resources. Land Economics XLIV, No. 1 (February) :87-99.
Stevens. J. B. and F. Bollman
1966. Quantitative measurement of the demand for and value of public recreation resources, Western Agricultural Economics Research Council, Report No. 8.
Stoevener, H. H. and W. G. Brown
1967. Analytical issues in demand analysis for outdoor recreation. J. Farm Econ. 49, No. 5 (December) :1295-1304.
Trice, A. H. and S. E. Wood
1958. Measurement of recreation benefits. Land Econ. XXXIV, No. 3 (August) :195-207.
Ullman, E. L. and D. J. Volk.
1962. An operational model for predicting reservoir attendance and benefits: implications of a location approach to water recreation. Papers of the Michigan Academy of Science, Arts, Letters, XLVII: 473-484.
Winch. D. M.
1965. Consumer's surplus and the compensation principle. American Econ. Rev. LV, No. 3 (June) :395-423.
Wolfe, R. I.
1966. Parameters of recreational travel in Ontario: a progress report. Toronto, Ontario: Department of Highways, Report RB 111.
Wood, D. F.
1961. The distances travelled technique for measuring value of recreation areas: an application. Land Econ. XXXVII, No. 4 (November) :363-369.

DISCUSSION

DR. ROBERT GILES: In your incident variable, did you consider the time aspect?

MR. CAPEL: No, we did not consider the time aspect and I suppose there is an obvious bias in that it is easier to cover the southern part of the province. The TransCanada Highway runs across it. On the other hand, more than half of the areas are reasonably accessible. Therefore, this may not introduce that serious a bias into the results.

DR. GILES: As I understood your presentation, your interest was in predicting future changes—things that will occur in the future, and you were using distance as a measure of demand. I don't understand why you were not using your regression against time in order to give you a projection into the future. Can you help me on that?

MR. CAPEL: I am not sure I completely understand the question. Do you wish to discuss the validity of making projections through time based on cross-sectional analysis?

DR. GILES: I was concerned with the objective wherein you indicated you were interested in determining or projecting or predicting future demands. I don't understand, therefore, how you avoided the implication of having done a regression by time as one of your major independent variables.

MR. CAPEL: We did study changes of time in a number of factors in this field and we did include a trend variable.

To make a projection we took our coefficients plus the factor for population change and the trends for time and participation. We did not assume that time would change the structural coefficient. We just had another coefficient for time that was added to the effect of distance and success.

DR. GILES: Did you regress population against time?

MR. CAPEL: No. I might say that the deer count has limitations and there were terrific variations from year to year, fluctuation in the deer population. I don't think it is possible to really make any accurate conclusions from that. You look at one area at a time.

DR. GILES: What regression did you get for distance traveled?

MR. CAPEL: For deer, we got between 3.64 and .67 and for moose we got between .27 and .54, including the two independent variables. For deer hunting we got from .57 to .45. I don't have the figure for moose but it was similar.

PROFESSOR WEEDEN: Are there further comments? If not, thank you for your discussion and I will again turn the meeting back to the Chairman.

CHAIRMAN JORDAHL: Thanks to the discussion leader, Professor Weeden, and our speakers and you in the audience for your questions. This session is now concluded.

* * *

TECHNICAL SESSION

Wednesday Morning—March 21

Chairman: DOUGLAS H. PIMLOTT
Professor, University of Toronto, Ontario, Canada

Discussion Leader: ROBERT L. HERBST
Commissioner, Department of Natural Resources, St. Paul, Minnesota

BALANCING HUMAN, WILDLIFE AND FISH NEEDS

REMARKS OF THE CHAIRMAN

DOUGLAS H. PIMLOTT

Perhaps I should speak briefly on the philosophy behind today's session. All of us face the choice in a session like this as to whether to use a generalized approach, or a specific approach.

When I was asked to act as chairman, the suggestion was that we try to get as close to specifics as we could. It seems to us that the use of land is one of the key areas. We have two papers that deal with the use of land—one in the United States, in an area of intensive population, centering around New York State and one of Canada in which there is an overview of some recent developments in multiple use, particularly in land-use control. Then, in the whole question of recreational use of land, there seem to be some important things on the horizon that society must consider in the near future.

What are we going to do about the increasing number of people who visit some of those recreational areas, sometimes in such numbers as to impair their own opportunities to enjoy the areas? In that particular case we specifically invited two people from the United States because the types of things that must be considered are moving faster in the United States than in any other part of the world.

Then, we considered that the way energy development goes in the

world, so goes the environment. We were faced there with a choice, again, to be quite general or more specific.

We thought at first of a rather general philosophical approach to the energy questions, but then we decided it would be much more useful to the people who attend this conference, if we got down to specific areas. And so we have people involved with environmental planning in the key area of oil shale development and one in the aquatic area, having to do with the handling of thermal waste.

So, that basically is what we had in mind when we formulated the session, and I am delighted to have a distinguished panel to work with here this morning. I am pleased to have the opportunity to work with the discussion leader Robert Herbst, commissioner of the Department of Natural Resources in St. Paul, Minnesota.

NEW OWNERS AND VIEWS ON NATURAL RESOURCES IN RURAL AMERICA

BRUCE T. WILKINS AND TOMMY L. BROWN
Department of Natural Resources, Cornell University, Ithaca, New York

Since World War II land use and ownership in the United States have undergone remarkable change. Changes in land use are hardly surprising, for the purposes our great land resources have served have been in constant flux since settlement by Europeans. The owners, however, have rather consistently been individuals whose motives have been to derive an economic return from lumber, grazing, farming or other economic activities.

In many parts of the country today the owners acquiring land are not primarily seeking economic returns and this means new attitudes, and behavior regarding trees, fish and wildlife are becoming increasingly important.

Between 1959-1969 more than 60 million acres of land left agriculture in the United States. This reverses a historic trend, for in many states the progression of land cover and use has been from virgin cover to cropland. In New York this pattern continued until at least 1880. Eighteen million acres (58 percent of the state) were classified as cropland, while 24 million acres (78 percent of New York State), was classified as farmland (cropland or forests owned by farmers) in that year (U.S. Census 1880). The 1890 Census indicated a reversal of this trend towards more cropland. By 1969, only 6.1 million acres in New York were in cropland (20 percent of the state) and 10 million acres (32 percent of the state) were in farmland (U.S. Census 1969). Fourteen million acres of land have thus shifted from farmers to other users in less than a century.

Subsequent uses of these lands are sometimes apparent. Airports, the transportation network of super-highways, and expansion of metropolitan areas to the countryside are occupiers of former croplands. Such land uses often "pulled" land from agriculture, due to their ability to outbid farmers for a given acre of ground.

Other major causes of land shifting out of commercial agriculture have been identified as "pushing" land from the traditional use. These acres have been forced out of agriculture because of competition from "better" agricultural land.

> The retirement of farmland in this State traces directly to such advances as introduction of new crops, genetic improvement of old crops, formulation of new herbicides and insecticides, manufacture of new fertilizers, preparation of new feed additives, improvements in livestock and in medical care, and development of new techniques for combining old factors of production. Mechanization has contributed to increased yields by permitting more timely planting and harvest, increased use of irrigation and better drainage (Conklin 1964).

Most superficial views of the shift away from croplands attributes primary losses to the pull of urban uses. In fact this appears to be a rather minor component of such shifts, although still of substantial concern.

For much of the country lands were pushed out of agricultural uses and it is these lands to which our remarks are directed. In some sections of the country (notably the Southeast) substantial portions were acquired by commercial timber interests. In the Northeast, and much of the Midwest, lands were increasingly purchased by a new type of landowner, one interested in use of land for noneconomic purposes. Few studies have been directed toward these owners, yet we contend they represent a major, and the most rapidly growing, segment of owners for many states and for regions within many other states although the research upon which this paper is based is restricted to Central New York.

The lack of published data and our limited personal knowledge makes it difficult to generalize as to the total applicability of our findings. We do have reason to believe they apply to most of the Northeast and mid-Atlantic states and to the less fertile areas of the Midwest. We believe they apply in a substantial degree to the far West and Southeastern states. Perhaps some of you can verify or refute that belief.

I don't intend to discuss our study in great detail. Those interested can get copies of the detailed study (Wilkins and Erickson 1971) at a

charge of $2.50 from the Center for Urban Development Research at Cornell University. Rather my hope today is to share with you some findings and implications from that study.

METHODS

We looked at three New York counties. Broome County is very urbanized, with an urban population of over 150,000. Yates County is quite rural having an entire population of only 19,000 and only 16 percent of its employment is in agriculture. Tompkins County is midway between the other two in size and degree of urbanization.

We located all the noncrop land in these counties, took a five percent sample of that land, and questioned all those owning ten or more acres in that five percent sample. For the survey-minded, we'll note that we had an 89 percent response rate from a total of 491 owners. An initial reaction may be "that's been done dozens of times" but careful analysis will show that is not so.

The sparsity of previous studies of such landowners reflects of course the historic patterns of land use and, perhaps, institutional inertia. Multitudinous studies exist of forest land owners and of farmers, there are a number of studies of commercial recreation firms, but few studies have looked at all those owning rural land. This was not a serious omission when farmers or wood fiber producers were the predominant land owners but these owners are controlling less and less rural land.

In our study we found only 17 percent of the noncropland landowners were actually farmers. I would note that industrial timber owners, while present, do not own major areas of noncropland in these counties. This presumably would be a substantial difference from some areas of the nation.

FINDINGS

Nonfarmers owned most of the land in our study area; indeed, they owned three times as much land as did farmers in Broome and Tompkins Counties. In the most rural county, the one with the largest proportion of good soils, almost half (46 percent) of the land was owned by nonfarmers. These are not small plots we're talking of; the average holding was 120 acres. The group holding the smallest average area, the city/absentee owners, averaged nearly 85 acres per family.

We found out a great deal about these owners. They covered a broad spectrum from those in the grasp of rural poverty to the affluent. Skilled workers and retired persons were extremely common;

each group constituted 22 percent of the total population responding in these counties.

Just under half of the families contacted in each county had incomes of $10,000 and more. Interestingly, in all three counties farmers had substantially higher income than did other on-site rural residents.

While a majority of these landowners (57%) had acquired land for economic reasons, (Table 1) this figure assumes less significance for future planning as we will see shortly.

Residency Group	Economic	Isolation	Environment	Recreation	Historical	Other	Totals	N
			Percentage					
BROOME COUNTY								
Farm	93	5	2	0	0	0	100	44
Non-Farm								
On-Site	53	30	12	1	2	2	100	142
Neighborhood	67	7	4	15	7	0	100	27
City/Absentee	55	8	25	7	5	0	100	75
Institutions	50	0	30	20	0	0	100	20
Non-Farm Totals	54	19	16	6	4	1	100	264
Broome County Totals	59	17	14	5	3	2	100	308
TOMPKINS COUNTY								
Farm	69	15	8	0	8	0	100	13
Non-Farm								
On-Site	35	30	24	2	9	0	100	46
Neighborhood	54	0	23	8	0	15	100	13
City/Absentee	50	13	37	0	0	0	100	8
Institutions	18	0	64	18	0	0	100	11
Non-Farm Totals	37	19	31	5	5	3	100	78
Tompkins County Totals	42	19	27	4	5	3	100	91
YATES COUNTY								
Farm	100	0	0	0	0	0	100	20
Non-Farm								
On-Site	55	20	0	20	5	0	100	20
Neighborhood	72	0	0	14	14	0	100	7
City/Absentee	50	8	17	17	8	0	100	12
Institutions	60	0	40	0	0	0	100	5
Non-Farm Totals	57	11	9	16	7	0	100	44
Yates County Totals	70	8	6	11	5	0	100	64
TOTALS								
Farm	91	5	3	0	1	0	100	77
Non-Farm								
On-Site	48	29	13	3	4	2	100	208
Neighborhood	64	4	8	13	6	5	100	47
City/Absentee	54	8	25	7	6	0	100	95
Institutions	42	0	42	16	0	0	100	35
Non-Farm Totals	51	18	18	7	4	2	100	386
GRAND TOTALS	57	16	16	6	4	1	100	463

TABLE 1. MAIN REASON(S) FOR BUYING-KEEPING PROPERTY, BY RESIDENCY GROUP

"Isolation" was cited as the major reason for acquisition by 16 percent of these owners. This motive was particularly common among on-site residents (29%). Rural "environment" was cited by another 16 percent as the major reason for acquisition of land. Among residency groups, institutions were most likely to cite this reason. Land acquired for nature centers or by rod and gun clubs would be recorded in the "rural environment" category.

The importance of the economic role in land ownership is shifting. If on-site residents who no longer farmed but cited farming as their

original reason for acquiring the land are dropped from the "economic" group, over 80 percent of these landowners did not at the time of the study hold their lands for economic purposes. Another indication of the decline in importance of economic reasons for land ownership is seen when farming reasons are arrayed by length of time held. Table 2 reflects this change.

Another shift, an increasing proportion of landowners who recently acquired property have permanent residences in an urban setting. Thus the proportion of city/absentee landowners was higher among the owners who had acquired their property recently than among those whose ownership had extended over many years (Table 3).

	Bought to Farm			
Years Owned	Did	Did Not	Sum	Total N
	Percentage			
0-3	8	92	100	(24)
4-7	20	80	100	(30)
8-10	23	77	100	(13)
11-20	25	75	100	(52)
Over 20	53	47	100	(77)

TABLE 2. PROPORTION OF ON-SITE GROUP HAVING ACQUIRED THE LAND TO FARM, BY THE NUMBER OF YEARS OWNED

Thus an increasing proportion of people are acquiring land for noneconomic reasons. We may well wonder, what these people do, or want to do, with their land, particularly as it relates to natural resources.

We took an extensive series of forest owner studies (in New York and elsewhere) as sufficient evidence that timber production was of minor interest to the majority of these noninstitutional owners. This is not to say interest cannot be kindled among them, nor that they are disinterested in income opportunities from trees, but we felt more adequate information existed on that aspect of management than on others.

We were interested in the "awareness" these owners had of the natural environment they had acquired, and of the actions actually (and prospectively) undertaken.

For example in terms of awareness, purchase of a book to aid in

Years Owned	Present Residence: New York City	Metropolitan New York Area	Other New York State Cities	Rural New York	Out-of-State	Total
	Number					
0-3	2	4	1	3	0	10
4-7	2	3	2	2	3	12
8-10	0	3	0	0	2	5
11-20	0	1	3	3	2	9
Over 20	1	0	1	3	3	8
TOTAL	5	11	7	11	10	44
Median Years Property Owned	4	6	12	14	13	7

TABLE 3. LENGTH OF OWNERSHIP OF ABSENTEE LANDOWNERS AND THEIR PRESENT RESIDENCE (1970)

identifying birds was a common activity; 44 percent had purchased such a book. On-site owners in Broome County were most likely to have purchased a book, but in Tompkins and Yates counties, several other groups were more likely to own such a book than were the on-site owners. These people not only read about and studied the natural environment, but substantial numbers actively manipulated their land to encourage wildlife.

Encouraging the plants and animals growing naturally on a property could enhance noneconomic returns obtained by landowners. Many landowners had recognized this opportunity, 60 percent or more of the on-site residents kept bird feeders. This same group was most likely to have put up bird nest boxes (one-fourth or more having done so) and, interestingly, 15 to 23 percent of these landowners had actively planted crops or shrubs for wildlife.

One of the more logical physical manipulations of these land areas for non-economic return is construction of a body of water, either a pond or a marsh. But while 44 percent of the landowners had one or more ponds located on their property, only 14 percent of the current owners had built the pond on their land. Of importance to fishery biologists, only 50 percent of those ponds apparently suitable for fish actually contained a fish population.

The patterns of activity would vary with the opportunities present in different areas of the nation but clearly these owners, and probably others purchasing land for non-economic reasons, are interested, and

active, in enhancing the enjoyment possible from the natural community, present or developable on their property.

This has substantial significance to most natural resource agencies. Some have recognized and shifted agency behavior to accommodate these new interests, others will or suffer loss of public support and involvement.

A couple of examples. Those interested in stimulating and assisting landowners carry out wildlife, fishery or woodlot management practices can work most effectively with these landowners in the evening, on weekends and in the summer, not 8-5 during the week.

Even our terminology needs to be re-examined. Fish management in farm ponds doesn't make as much sense when most artificially constructed ponds are not owned by farmers and the owners feel they don't have a farm pond.

Another implication to management agencies, as the percent of landowners holding lands for non-economic reasons (isolation, recreation, etc.) increases, the amount of posted land is very likely to increase. This may present major problems as agencies use hunting as a control for wildlife populations and as they try to coordinate hunting, fishing, and other recreational experiences between private landowners and the general public.

The Department of Natural Resources at Cornell University using grants from the Wildlife Management Institute, the New York State Conservation Council and the New York State Department of Environmental Conservation, has launched a detailed study on attitudes of the rural landowner in New York toward use of their lands by the public for recreation. This report should be available early in 1974 and help clarify possible agency response to help solve some of these problems.

Wildlife and natural resource agencies generally have an opportunity long dreamed of. Increasingly those owning rural lands are keenly interested in wildlife, for observation or for hunting. The interest in managing rural lands for wild forms of life has probably never been as high as it is today, and it will be higher tomorrow. Hopefully wildlife and natural resource research and management agencies will be in the vanguard, building on this interest to enhance the status of wildlife in America today.

LITERATURE CITED

Conklin, Howard E.
1967. Open space and the farmer. Paper presented at a seminar on preserving open space in expanding urban areas; sponsored by N.E. Regional Resource Econ. Committee. 4 pp.

U.S. Dept. of Commerce. Bureau of the Census.
1880. Tenth Census of the United States: population

———.
U.S. Census of Agriculture, 1969.

Wilkins, Bruce T. and Eugene C. Erickson.
1971. Rural non-farmed lands and their owners: a study of three central New York counties. Office of Regional Resources and Development, Cornell University. 143 pp.

DISCUSSION

DISCUSSION LEADER ROBERT HERBST: Thank you very much, Doug and Bruce for a good paper. This paper has highlighted the new owner opportunity that we have to work with, but I also believe that it has served to highlight one of the most dramatic changes in land use that we have in our country that has affected our wildlife and our total environment.

The most critical environmental problem we have is to balance our needs with the resource potential, and with an overall minimum impact on our environment.

Land-use planning and rezoning are going to be significant tools for the agencies in dealing with that problem. For example, in the State of Minnesota we now have land classification under which each 40 acres of public land is classified to its highest and best use by a team of specialists. We will have some 11.5 million acres classified in our state by midsummer. We have shoreland zoning in which we have classified all the shorelands, both on lakes and rivers, and set a model ordinance which all of our counties have now adopted.

We have flood-plain zoning under which we have now identified all the flood plains and have set up a compatible management program for them.

We have water-use zoning under which we have the authority to zone the surface use of all public bodies of water; we have environmental review procedures; and we have developed a new program of computer use and resource management. We look to this session of legislature for more land-use legislation.

We are recommending a critical area act which would give us authority to identify critical areas and zone them against incompatible use and a scenic rivers Bill, patterned after the federal legislation. We are recommending a Sub-Division Act and significant appropriations for land-use planning.

Congress, too, has a tremendous interest in land-use planning. So with that emphasis on the need for land-use planning, and the dramatic changes that have taken place in land use in our country, we are open to additional comments, or any questions you have on Bruce Wilkins' paper.

ROBERT REAM (University of Montana): First of all I want to assure Bruce that similar things are happening in the West, in Montana, resulting largely from individuals coming from California; we refer to it as the "California-cation of Montana."

Bruce, did you also examine changes in land access and the attitude on the part of landowners towards access, either for consumptive, or nonconsumptive use?

DR. WILKINS: Tom Brown, the other co-author of the paper.

MR. BROWN: We did investigate this as part of the study in these three counties and found that posting among the landowners is in the area of 50 percent.

We are now doing a much more comprehensive study, thanks to a grant from the Wildlife Management Institute, on posting and access problems and landowner attitudes throughout New York State. That study is currently under way.

FROM THE FLOOR: Could you elaborate on the figure that you had for economic reasons? That is 57 percent, which was the largest group; and I presume they will also be looking for an investment. Do you have any idea of their plans for selling in the future and if they are more likely to sell for development?

DR. WILKINS: We have a fair amount of information on that and the total study is available in booklet form. The vast bulk of that 57 percent are farmers. On the other hand, 51 percent are nonfarmers, as identified for economic reasons. Most of the people who purchased land for farming shifted out, for one reason or another; and that left only 20 percent who had other economic reasons.

That 20 percent would, in fact, largely be speculators, investors, people who thought it would be nice to have a place in the country, but that it seemed like a good investment, too. Those would be identified as economic reasons.

People who hold land for development clearly are more likely to sell. We present data in a larger publication on the actual turnover rate by reason of ownership. Where these developmental investment interests are high, the land ownership is changing every three or four years. It is changing very rapidly.

DEVELOPMENTS IN MULTIPLE USE OF CANADA'S PUBLIC LANDS[1]

W. WINSTON MAIR
Department of Regional Economic Expansion, Ottawa, Ontario

Most of the land and water surface of Canada remains in public (Crown) ownership, but public ownership within the ten provinces resides in the right of those provinces, not in the right of Canada. Thus there is added to the diversity of physiographic regions and land types the management philosophy of ten different provinces, plus those of the Federal Government as exercised in national parks, military reservations and sundry other national holdings. North of 60, in the Yukon and Northwest Territories, a different situation exists. Being repeated in degree is the early history of Western Canada: Territorial Governments carry authority and responsibility for many of the functions of a Provincial Government but ownership and regulation of the resources, including land, essentially remains with the federal authority. I am indebted then to associates in the several provinces and territories for their ready response to requests for information and failure to mention any particular province hereunder should not be construed to mean lack of either co-operation or facts of interest respecting those areas.

Given the complexity of the situation, both geographically and legislatively, this paper is directed to a discussion of certain trends and commonalities. Anyone wishing to delve into specifics is directed to the publications of the Canadian Council of Resource and Environment Ministers, which attempt to collate information on legislation, policies, administration, etc. of the various governments concerned[2] or to the individual governments themselves.

Indicative perhaps of the times is the fact that over approximately the last decade most land authorities across the country have rewritten their various land and/or resources acts and regulations (or are in the process of so doing). Interestingly enough, however, this was started by dedicated land managers/administrators concerned with continued encroachment on and erosion of the basic authority to control, and hence use "wisely," our primary resources, rather than

[1] In the absence of the author, this paper was presented by Mr. A. G. Loughrey.
[2] For example see: The Administration of Crown Lands in Canada, Canadian Council of Resource and Environmental Ministers, 1972.

because of the present public concern respecting environmental management, multiple land use, recreational land use and so on. It was rather an instinctive reaction based on long experience and a deep-rooted concern or love for land. The situation and the legislative means for dealing with it have, however, become very rapidly more complex due to burgeoning major development schemes, outdoor recreation needs, citizen group representations and so on, with the result that draft legislation gets written and rewritten in an attempt to find simple, all-embracing wording that provides the two opposites of control and maximum flexibility.

No single group or sector has been responsible for the rapid developments in the land-use scene—many parties have contributed in varying degree and in time and place. However, it is fair to say that the Resources for Tomorrow Conference held at Montreal in 1961 triggered a whole range of actions that have hastened our steps to where we now are. That Conference led to formation of the Canadian Council of Resource Ministers, which led to a National Pollution Conference in 1966 and a series of other lesser conferences and seminars dealing with water, land, forests and resources development generally. The National Man and Resources Conference to be held at Toronto in November this year will deal with twelve major topics of which at least six will touch on land problems, and should provide yet another landmark in the Canadian search for direction in land use and resources management.

Concurrently with these conferences and seminars, two Federal-Provincial programs of particular significance were undertaken, the Canada Land Inventory program and the Agricultural Rehabilitation and Development Act program. The former, totally federally funded, was carried out by the provinces who assembled competent technical-scientific teams to study and report upon the land use capability of approximately one million square miles embracing portions of all ten provinces. Those staffs and those data made possible some of the best beginnings of truly integrated land management. The ARDA program was and is a jointly financed venture that, while largely directed to agricultural land problems, involved planning for water, for the recovery of marginal lands into Crown hands, and the preparation and implementation of multi-use plans for significant land areas. (More recently the ARDA program has been extended to remote communities.) Many other government programs, both provincial and federal (*e.g.* under the FRED program (Fund for Rural Economic Development) and under the Canada Water Act) have developed over this same period and contribute significantly to both our thinking and our action. However, the CLI and ARDA programs

will be seen, in historical perspective, as key elements in development of government attitudes towards land use planning during the 1960's.

Given then this sketchy background, the remainder of this paper will be used to consider any observable trends and predictions for the future. Situations referred to are indicative of thinking in Canada, and not to be construed as being the only examples of what is really a very constructive major ferment in the area of land management.

LAND OWNERSHIP

The literature is replete with historical references to the attachment of man to land. It may be the same vaguely felt affinity that draws urban dwellers to the countryside holidays and weekends in such numbers as to confound transportation systems. Certainly it was the opportunity to gain ownership of land that drew many of our forefathers to Canada and into its wilds. However, with more and more people living in the urban areas where they own no land, the tendency is for easily accessible land surrounding such areas to be owned by fewer and fewer persons.

Where then are the landless to go to enjoy contact with the land? It is this dilemma that has exercised governments, and with the advent of regional/area land-use planning has frustrated planners and administrators alike. Certainly there are some techniques for making landowners conform to certain rules or standards (of land use, beautification, access, etc.) conceived to be in the public interest, but the kind of flexibility of action needed to meet the dynamics of the future seems yet elusive. As a consequence, it is generally the case that governments are not only slowing down the sale of public lands to individuals, but they are also acquiring private holdings by a variety of techniques, to provide the necessary control of the land base. For example, Crown land is not generally available for purchase in Manitoba, but may be used under lease, permit or the like. Considerable acreage of alienated land has been purchased and returned to Crown land status.

A recent report indicates that the Province of Ontario is prepared to undertake bold moves in the area of land use and planning. An Ontario Minister of the Crown is reported to have said that more money will be spent to acquire land for public use and strict regulations will be enacted to govern landowners in respect to what they can do with their property. Of particular concern is an area of the southern populated fringe of the province, but actions there will certainly be echoed in land policies elsewhere in the province.

Government interest in public ownership, and hence planned use of land, extends far more widely. A Prince Edward Island survey

reportedly concludes basically that the establishment of a Crown Land Bank would not be detrimental to the farming population, and so woodlot management might be possible under government auspices. The interesting point here is that a province so intensely privately owned can be discussing publicly the benefits of that kind of a step.

Saskatchewan, in 1972, established a Land Bank Commission to buy farms from retiring farmers and lease the land back to young farmers who wish to get started or to expand their holdings. The leases will be long-term and are designed to protect the farmer—while the farmer can break his lease if he wishes to stop farming, the Land Bank cannot break it except in default on rental or tax payments. There is a purchase option that may be exercised after five years but the hope seems to be that a combination of public land ownership with private land management will maximize effectiveness in agricultural land use.

Brief reference might be made again to the urban land situation. In an address in Halifax, November 15, 1972, to the Community Planning Association of Canada, D. H. Fullerton, chairman of the National Capital Commission, Ottawa, stated four reasons for greater public ownership of land if we are to have intelligent urban planning in Canada. They were: (1) land is a resource, not a commodity, and being scarce, must involve government in its allocation; (2) the present system is immoral, unjust and unfair to society since it provides the land speculator with a superb instrument for taxing society, but we have no good way to make him contribute a larger share of his gains to society; (3) government control of land is absolutely essential to the development of good planning of our cities and of our countryside and (4) government should be in the land business because it is good business—it pays. He quoted Henry George: "The land of every country belongs of right to all the people of that country—cannot be alienated by one generation. Private ownership of land has no more foundation in morality or reason than private ownership of air and water."

Though he expressed his views as personal, Mr. Fullerton also said he suspected the direction of current thinking of many Canadian Governments, at all levels, may not be vastly different from his own. Saskatoon, Saskatchewan has owned, assembled and sold land for building lots for many years, a social use of land. More recently, a 1971 report of the Science Council of Canada recommends that governments make greater use of public ownership of urban and expansion area land in order to reduce speculation and ensure freedom of planning. It is interesting that the Federal Government recently announced a major program of financing to assist provincial

and municipal governments with urban matters, including land assembly.

FOREIGN OWNERSHIP

This is a part of the total question of land ownership, but because of its current status, merits special mention. The question of foreign ownership of land is topical, and controversial, in many provinces in Canada today. Time does not permit a full review, but a few examples of what is being said and done may be constructive. Nova Scotia has recently proposed tough new measures to control foreign ownership, including right for the province of first refusal on the sale of now alienated prime recreational land and introduction of a nonresident land transfer tax to help support government recreational land purchases. Prince Edward Island has established a ceiling of 10 acres on nonresident land acquisition without Cabinet approval. New Brunswick has so far not placed any restriction upon sale of Crown lands to anyone, but it is interesting that in the last five years the province only sold 77 parcels of Crown land of which three parcels totalling 47 acres went to United States citizens. (However, the province acquired nearly 200,000 acres back into Crown land during the same period.) In the West, an interim report of the Alberta Select Committee on Foreign Investment supported the principle that Canadian lands should be owned and controlled by Canadians, but qualified this endorsement with concurrence in the common law right of an individual to dispose of his property as he wishes. This is related to Bill 107, an amendment to the Public Lands Act, introduced at the spring sitting of the Session of the Legislature in 1972, which provided for restricting sale of land to nonresidents, would prohibit sale to individuals who are not Canadians and would provide means to regain control of land sold to a Canadian and subsequently sold to someone not meeting the ownership requirements. It is believed the matter is still under study, but since the acquisition of Crown land over the past 12 years by United States citizens who are still United States citizens appears to be less than 1,000 acres, the matter is not presently critical.

The point here is not one of anti-United States sentiment, though bits of emotionalism may spring up here and there from time to time. Rather, what is at question is the ability of governments to control what happens to our basic resource of land, and the ability to be flexible in land use planning to meet yet dimly perceived needs in our dynamic society.

PUBLIC LAND USE PLANNING

Reference has been made to the complexity of the situation, both geographically and in terms of policies and regulations. A few

examples are here given which are indicative of the kinds of approaches currently in use. Two different situations are discussed: (1) community areas and agricultural land and (2) remote areas.

(1) *Community Areas and Agricultural Lands*

New Brunswick proclaimed on January 1, 1973, a new Community Planning Act providing for planning for all unincorporated areas, and about 60 regional, area and community plans covering the entire province are now in process of development. Regional plans will contain a statement of planning policies for orderly economic, social and physical development of the region, including the development and management of natural resources and the control and abatement of pollution of the natural environment. Of particular interest is the section providing that while a regional plan shall not commit the province to undertake any proposal therein, it shall disallow the undertaking of any development in a manner inconsistent with or at variance with any proposal or policy therein outlined or proposed. The same situation is to obtain for any area plan that is developed. This offers a degree of control that has been sadly lacking over public lands generally, and should prove of interest to land administrators throughout Canada.

Alberta has a somewhat unique position among the ten provinces in that it is the only one that has really major areas of Crown land with significant renewable resource potential, including agricultural potential. That province indicates that the pressures of use on land, created by increasing population and increasing affluence have forced greater co-operation and consultation on management agencies on the one hand and on the other, have made the public more receptive to concepts which used to be regarded as punitive or unnecessarily restrictive but were in the public interest. They have a Land Use Assignment Committee, which identifies the renewable resource potentials on Crown lands and determines the most suitable combination of uses under the social and economic conditions.

Of rather special interest is the situation in and around the communities in the Northwest Territories. All unalienated lands there have the status of Crown lands under the administration of the Federal Minister of Indian and Northern Affairs. The Territorial Land Use Regulations, promulgated in 1971, are designed to ensure that operations conducted on the surface of land in the Yukon and Northwest Territories have a minimal effect on the natural environment. However, on the Minister's recommendation, the administration of certain Crown lands may be transferred by Orders-in-Council to the administration of the Territorial Government, which then has the

power to dispose by sale or lease. Not long after the Commissioner and his staff moved to Yellowknife in 1967 a policy decision was made to transfer to the Territorial Government all disposable Crown lands in and around the settlements, and to date, eight transfers have been made and 53 more settlement areas have been sketched provisionally for further transfers (areas up to 260 square miles each). Surface rights including timber and quarry materials are transferred but not oil, gas or other minerals. Prime responsibility for planning has also been delegated, including settlement lands not yet transferred. Speculation is avoided, community council views are considered in either planning or land disposition, and a considerable tendency to lease land rather than sell has developed through the view that land is a resource, not a commodity. The Territorial Government believes that the process of regulation begins with planning and more than 100 planning and engineering studies have been produced.

(2) *Remote Areas*

Remote area land use presents a quite different situation than that in the more settled areas. (The settlement areas of the Yukon and Northwest Territories could equally as well have been discussed under this heading.) Urban enclaves spring up related to major resource potentials—usually minerals or timber—then placing demands upon surrounding areas for either the exploitable resource (as with forestry) or recreation. Small, scattered and remote settlements place limited pressure upon the land, but the inhabitants range widely for fishing, trapping and hunting and some forestry may take place. Between the settlements of varying types there is the wilderness; industry, southern recreation seekers, assorted entrepreneurs, and the native northerners of the settlements all seek to use what is free (Crown) land. Governments, usually through their resource departments, have administered the North or mid-North for years, with modest success despite some setbacks that have occurred. Now the floodgates of use and development are opening and the old, simple rules are no longer adequate. Development is now policy, not happenstance; the question is how and by whom, and management of land and resources has become exceedingly complex.

British Columbia has economic development reports covering much of her "remote" territory, but these tend not to be integrated planning/development in nature. Alberta has done considerable area planning respecting her northern areas, but is just now planning in truly integrated fashion towards major goals. Ontario has planning reports in print respecting the north-western and north-eastern planning regions which set a solid foundation for economic develop-

ment planning. However, perhaps Manitoba has best attempted to conceptualize in totality the development and management of her northern land and resources. There they have attempted to paint a plan/picture of resource potentials, land uses, transportation corridors, people needs and development priorities which, if refined and used, cannot but prove a major breakthrough in remote (public) land use planning. Discussions between provinces, and between federal departments and provinces, are taking place more and more frequently through a variety of mediums and both the quality and the quantity of multi-use land planning are increasing at a most gratifying pace. (Our ability to put plans into effective action may prove a greater barrier to progress than the planning.)

WATERSHEDS AND PUBLIC LANDS

Watershed management has been practiced in Ontario for many years, but has been largely a concept elsewhere until the last decade. Crown Land Acts (under whatever name) or Forest Acts have, of course, for many years specified in most, if not all provinces, restrictions on cutting timber peripheral to lakes and streams. Increasingly, more restrictions have been placed upon the alienation or other disposition of lands bordering lakes and streams. More recently, however, concern with public (and private) land use within the total watersheds has come to the fore, due again in large measure to the combination of forces already described. Canada has a long way to go, but the number of very detailed and major studies now underway, many under federal-provincial aegis, is a most exciting trend.

PARKS, RECREATION AND PUBLIC LANDS

The tourist/recreation business is at least the third largest earner of foreign dollars for Canada, and on occasion ranks second. Outdoor recreation, including hunting and fishing, has required a substantial rethinking of our resources policies and our land management. It is perhaps not too strong to say that in some instances "tourist" recreation has loomed as a single-purpose use, potentially as controversial as the "dam builders and cattle grazers" not so long ago in the sights of every conservationist. Fortunately, both the knowledge and the practice of multiple land use have so far advanced that the planning now developing should hopefully avoid serious recriminations. It is a fact that should be recognized, however, that there are schisms between tourist development/park planners and resource/land-use managers. There have been major additions to the national parks system in Canada in the past few years and one hopes there will be more. Examination of the situation shows, however, that those

additions were in the main either in the Atlantic Provinces where major efforts are afoot to develop greater economic activity in the region or in the Territories.

Most of the larger provinces are inclined to retain jurisdiction over potential park lands which could be developed provincially, thereby allowing for the option of planning some well-controlled harvesting of timber, mineral, wildlife or other resources should economic necessity arise. The parks controversy need not be fanned here, and will presumably rage on for years to come. The brightest hope is the strong move to regional and area planning for land use and resources development. One is genuinely hopeful that this process will make more abundantly clear that national, provincial and regional parks can be successfully fitted into resources/land-use plans, if we put our minds to it. The hope for adequate nature reserves too, given a major lift by the International Biological Program, may well rest on the present emphasis upon multiple land-use planning. British Columbia leads the way with a plan for 100 ecological reserves to be established by the end of 1975.

CITIZENS GROUPS AND PUBLIC PARTICIPATION IN LAND USE

A remarkable phenomenon of the last decade has been the development and strength of citizens groups in Canada. If I am correct, the oldest sportsman's club in North America is in Quebec and Canadians have not been lacking in concern expressed through hunting and fishing clubs, naturalists groups and the like. However, the past ten years have seen the maturation of thinking and organization of these groups—a fact that has contributed in no small measure to advances that have been made in integrated land/resource management. Some people tend to see their activities as negative, as these groups challenge hydro developments or incursions on parks or the like. In my view this general image is quite wrong and does grave injustice to very many dedicated individuals from all walks of life who devote time and money to what they conceive as a responsibility to our nation and to future generations. At any rate, it is safe to say that no plan of any consequence for either the single or the multiple use of public lands or resources in Canada will go unscrutinized—that fact can only ensure that planning and decision making by public servants will get better all the time.

More general public participation in land-use decisions is now recognized as essential by all jurisdictions, and is increasingly sought through a variety of techniques but in particular, public hearings. There is much to be learned on how to make such hearings effective, but their value is recognized and accepted throughout all provinces.

Most noteworthy in respect to the philosophy respecting public land management is that public hearings should not just be held in the particular part of a province or region concerned—they should be held more widely. It is a measure of public interest that what happens with resources in the Mackenzie Valley is of great concern to citizens in Toronto or in Victoria. I don't wish to overdo it, but concern with resources, with the environment, is one of the strongest forces that we have to link citizens throughout the nation—government ability to relate to that force is still embryonic and a concern of most administrators.

ENVIRONMENTAL MANAGEMENT AND PUBLIC LAND USE

There must be some of long association with resources management and this conference who shake their heads at the current popularity of concerns they carried almost single-handedly for so many years. Well, that is the way it goes. Every province in Canada has taken some special steps to meet the environmental challenge, most through the establishment of a department or major agency. The Federal Government has formed a Department of Environment that embraces agencies concerned with water, land, air, forestry, fisheries, wildlife and so on. Whatever the makeup of the different departments, the rules seem the same—the activities of individuals, collectivities of people, industries and governments are subject to scrutiny and appropriate control, and public land-management agencies are no exception. Thus environmental impact studies are close to becoming mandatory for all major development proposals and, for example, several millions of dollars have been spent by both industry and government on such studies for a pipeline along the Mackenzie Valley, with others in train for a possible Arctic Islands pipeline. I have always argued that good land-use management was good environmental management, but certainly now one more safeguard has been established, to ensure that multiple land use is truly meaningful in the modern context.

None of us is so naive to suppose that because of what I have said, all is well. Good intentions have been stated; good beginnings have been made. There is reason for some quiet self-congratulation here and there, but no room whatsoever for complacency. Truly, the pace of change is so rapid, developments so many and varied and the goals of our society so undefined that the challenge is almost frightening. Yet we know we have the ability and the means to meet the challenges, if we only have the wit and the will. To achieve these we must search out and prize ideas and leaders. This conference has a major role to play in that respect.

What do the developments herein reported portend? We will see continued government intervention in land ownership, as it comes home to each one of us more personally that land belongs of right to all of us, as much as do air and water. Individual responsibility will tend to be directed by government, to match that right. Regional and area multiple land-use planning will increase and improve, with the major problem proving to be how to bridge the gap between sound planning and sound implementation. Such integrated planning and management will strengthen watershed management, can solve environmental problems and can bring harmony with parks and recreation. But unless means are found to adequately communicate with the people in order to identify our common goals, the increasing knowledge of the technocrats will not solve our problems over the next ten years.

REMOTE AREA PEOPLE AND PUBLIC LAND USE

This presentation would not be complete without some reference to the need for some rethinking of land management as it affects people of our remote settlements—largely citizens who are Indian and Métis. Land entitlement of Indian and Eskimo people in some areas is presently under review and no useful purpose would be served to discuss that. Similarly, the Métis people are studying certain historical claims which it is not proposed to discuss in this paper. What is required to be said here is that there must be some rethinking of the modes of land tenure and resource management in the remote areas because the southern concept of ownership and land occupation simply does not apply. As long as but few southerners intruded into the remote areas, little problem arose, apart from a general imbalance between a finite resource base and a slowly increasing human population. Native people "occupied" a large territory, using the resources and moving from time to time, seasonally or as local resources dwindled. They occupied but did not own the land. In recent years, however, forest industries have moved in, mining developments have occurred, new industrial enclave populations use surrounding areas for their recreation, external forces such as hydro companies use remote land and water to satisfy southern needs, and private lodge owners and others either move in or make sporadic forays to exploit the fish, game and recreational resources of the area. All this is done quite legally but takes little account of effective occupation by the native people over hundreds of years. Obviously, there has to be a rethinking of the whole question of land use, land title, and resource use—if justice is to be done.

DISCUSSION

CHAIRMAN PIMLOTT: As you can understand, with such a wide-ranging paper Mr. Loughrey is rather unwilling to deal with every question for obvious reasons.

So, there are a number of people in the audience, who we hope will participate in the discussion, for instance Dr. Gassom from Quebec, and Don Johnson from Ontario; Mr. Passmore who is very knowledgeable on Northern questions; and Mr. Paul Dean who has acted in the interphase between some of the land classification and planning schemes.

There are a number of people like that who we hope will feel free to get involved in discussion from the floor.

MICHAEL NADEL (The Wilderness Society): Does Canada now require an environmental impact statement before offering a gas and oil pipeline corridor? Does Canada restrict the width of right-of-way for such a corridor? And finally, what do you judge to be the prevailing sentiment in Canada to allow Alaska oil go through the Canadian corridor?

MR. LOUGHREY: I'm afraid my answer may be unsatisfactory, and I therefore welcome any contributions from anyone in the audience who has specific information.

We do not have a requirement for environmental impact statements or studies as you have them in the United States, but any application for a pipeline, either gas or oil, would be heard by the National Energy Board, which is responsible to the Minister of Energy in the Federal Government.

I believe, and I'm not sure of dates, that we may entertain hearings on pipeline proposals, particularly the gas pipeline in the corridor, perhaps as early as late '73, but more likely sometime in '74.

As you know, environmental studies by various resource agencies have been very heavily funded and are being carried out by quite large teams, and have been for the last three years.

I'm afraid I can't answer your second question with regard to width of the corridor; and I'm not sure there is an easy answer to that now, because, in the first place, we are talking about the possibility of two pipelines, a gas pipeline and an oil pipeline. It is conceivable there might be slight restrictions on the oil pipeline, so they might not be parallel.

At the same time, there is the Mackenzie Highway planned for the corridor, and very recently there has been a significant push for an investigation of the economic and environmental feasibility of a railroad in lieu of an oil pipeline. The matter of corridor width will probably be decided in the National Energy Board hearings.

Finally, it would be presumptuous of me to answer with respect to the prevailing sentiment on the movement of American oil through Canada. Doug Pimlott and Mr. Passmore might be in a better position to state their views on that. I can merely say that they are mixed, and I'm sure the question will be debated in considerable length.

DR. PIMLOTT: Dick Passmore, would you care to comment?

MR. RICHARD PASSMORE: Certainly many Canadians are now discussing the potential for transporting crude oil southward by whatever means, or route.

We are concerned that if the Trans-Alaska pipeline system and the tanker route extension are chosen as a means of transport we run a somewhat high risk on the west coast of Canada; so we entertained the thought of asking you to delay while we examine the possibility of alternate routes through Canada. Alternative routes would include transport by oil pipeline, gas pipeline, and by railroad that might carry both products through Canada.

Sentiment regarding transport of oil through Canada is still taking shape, and has not formed in any particular direction. I personally think that sentiment against pipelines in the Mackenzie Valley is gradually shaping up. People are concerned about the environmental impact of pipelines built over permafrost, and several hundred miles of any proposed pipeline would have to traverse over permafrost, and the environmental damage could be considerable.

There is a problem of economics for Canada involved in routing two pipelines. I

don't know of any recent good estimates of total investment, but it is going to cost somewhere around 10 billion dollars to construct both gas and oil pipelines. Economists tell us that would do rather drastic things to the value of our Canadian dollar and might well cause us real problems in our ability to trade with other nations.

The railway, on the other hand, requires an investment of somewhere around 3 billion dollars; and we think that is a figure we might be able to live with.

Other problems relate to the employment which may be offered to northern natives. The pipeline is a boom-and-bust type of thing for them; three to four years of intensive activity on construction, and then the bust to almost no employment opportunity whatever. In the meantime they will have become accustomed to the wage economy and will have lost some of their enthusiasm to going back to the subsistence economy.

The railway, on the other hand, offers almost five thousand continuing jobs in Northern Canada, a large portion of which could be filled by native people.

So, if I read correctly, there is a shift towards a kindlier attitude towards accepting a rail line, and slight hardening towards the pipeline.

UNIDENTIFIED: Has the U.S. Secretary of the Interior consulted with his counterpart in the Canadian Government with respect to a possible alternative?

CHAIRMAN PIMLOTT: Dick is very close, again to the national scene with his office in Ottawa. It is my impression that there has been no direct consultation, but I'm not certain. This type of consultation often occurs between our governments with the people involved maintaining a low profile, so it is quite possible that it has happened, and we are not aware of it.

There is an evening flight from Washington to Ottawa, and a morning one in the opposite direction. There is a lot of consultation that is not of public nature.

Dick, do you know anything specific on that question, whether or not Secretary Morton has had direct contact with our government?

MR. PASSMORE: I am under the impression that there has been no direct consultation between the two governments since last May, at which time the Minister of Energy, Mines and Resources did make some proposals to the American Government, and he feels he was rather soundly rebuffed. He is not about to make any further proposals unless there is some good chance that be can come up with something acceptable to his American counterparts.

I recall a television commercial from one of your companies in which they said in their search for oil in Alaska they were providing the natives, the Eskimos, and the Indians, with certain engineering skills, and although they didn't discover any oil, nevertheless, they left the natives with skills. They haven't said where those skills are being applied.

STEWARD BRANDBORG (Wilderness Society, Washington, D.C.): The Congress has before it legislation that would mandate thorough, objective, scientific investigations in the period of the next year or year and-a-half, to determine the full economic and environmental impact of the various Canadian alternatives, the Mackenzie route, railroads, whatever may be most practical.

Do Canadian interests, as represented here, favor such exploration of alternatives which up until now has been precluded by the Department of the Interior, the White House, the Federal Government in the United States? We have not been able to get this data.

MR. LOUGHREY: This is, of course, news to me, but I would think the official answer to that would be, yes, they would favor full consultation to explore alternative routes for moving oil. It has great national significance. Also, as an environmentalist, it has great environmental significance. We are all interested here in this room, I assume, in minimizing damage, whether it be spills on the high seas, or whether it be spills from pipelines, or earthquake zones, or disruption caused by building.

* * *

RESTRICTING HUMAN USE OF PUBLIC LANDS IN NORTH AMERICA

TOM D. THOMAS
U.S.D.I., National Park Service, Stephen T. Mather Training Center, Harpers Ferry, West Virginia

This paper is not intended to serve as a research and/or scientific treatment for the restriction of human use of public lands. There are others in the variety of involved disciplines far more capable than I; however, I have been involved with training, implementing, and development of changing management plans.

The National Park Service, as well as other public land-use agencies are deeply concerned over future visitation and its impact. We all agree there is a vital physical and psychological need for people to experience and respond to our natural, cultural, and historical heritage.

To accomplish this we must understand and use the researcher's theories, statistics, recommendations, and development data for the greatest benefit. All social, cultural, and economic life styles are the beneficiaries, provided we plan well for the future of public land use.

Attached is a reference list of several research studies which provide valuable data for use by today's managers.

The National Park Service has historically been known as a conservation, preservation organization. At the same time, its commitment is to the public—making it a total public-service oriented organization. It has been difficult during the years since 1872 to rationalize and justify these two objectives. To make each area of the National Park System available to the public of the world and yet to preserve it for all future generations has indeed been a difficult task. Until a few years following World War II there seemed to be no particular problem. True, our visitation was increasing year after year; however, we were able to meet the needs of most visitors without noticeable damage to the resource.

As this increase grew more rapidly, a very progressive and innovative program was introduced in the mid 1950's called "Mission 66" aimed at developing the parks to their full potential for use by the visiting public. We must remember that during World War II little or nothing in development was done in any of the parks due to lack of money and personnel, and as a result, roads deteriorated, many parks and monuments had no visitor centers; in fact there were few appropriate buildings from which to work. The result was park roads being renovated and to some extent enlarged during this 10-year period. Visitor centers and other public-use facilities were constructed.

This appeared to be the trend for years to come if we were to keep up with the annual visitor increase. Very few saw the handwriting on the wall in terms of the crisis we were approaching. It must be noted, however, as far back as the 1930's and 40's there were those farsighted park people who were saying the parks were becoming too crowded, overused; that people were overshadowing and in some instances destroying the natural or the historical resource. They insisted it was only a matter of time until sheer numbers would totally destroy the purpose of the park as well as affect the quality of each other's experience. One such farsighted person was Boss Pinkley, General Superintendent of the Southwestern Monuments, who wrote in his rumination to the "Chief," a title he reserved for the Director, while his signature was simply "the Boss," that it was time we began to study the visitor and attempt to find out who he was and what he really came to the area for. This was as early as 1935, and I quote from his rumination of November 1935:

> If we consider it necessary to band the little birds as they come and go and study their habits and customs, if we conduct research problems into the private lives of the chipmunks, and deer and bears and other things which impinge somewhat on our basic duties; if we can wag our finger and bring a flock of specialists to our aid when we find a few strange bugs in our trees, and another wag will bring another set of specialists who will tell us how to handle our trees, doesn't it seem reasonable to you that we ought to call on someone who can tell us how to handle and how not to handle the visitors who make up one of the two legs upon which we stand? My contention is, that if it takes a specialist to know what a bug thinks, or to know why a chipmunk wags his tail up and down instead of sidewise, and we wouldn't expect a specialist in that line to be a specialist in the reactions of visitors as well, perhaps we had better consider calling in a specialist in visitors to do some research work among more than 200,000 visitors we are going to have this year. . .

He continues. . .

> We hold that visitor is at least as important as a bug because if on no other grounds he can do as much or more damage than the bug and it is against the regulations to exterminate him. You can only use preventive and protective measures.

Such men as Boss Pinkley were aware of the oncoming problem in the development of parks, of their overuse and of the ecological damage that was eventually going to threaten these jewels of our

country. Confirmed by a visitation in 1950 of 33.3 million and in 1970, 172 million.

Fortunately for us these few continued their efforts and the idea and apparent need grew until we now have sociologists who are making every effort to find out—what does the visitor think, what are his needs in a park, when does he feel the experience is not good enough because of overcrowding? How does his visit relate to his home environment and work experience? There is a study in process by Dr. Neil Cheek, Research Sociologist, National Park Service, which is now beginning to provide us with insight into the visitor, his needs and attitudes. We also have research biologists who are studying the ecology of the parks, identifying what we are doing as we build roads, reconstruct or plan new buildings, to the natural balance for which the area was set aside. Other studies include seeking answers to architectural, capacity potential, and development problems. Already this information is affecting our management principles throughout the Service.

Upper Yosemite Valley serves as an example of how research and study have already affected management decisions and actions aimed at restricting and controlling visitor use. The Valley with its network of roads which were developed over the years, had become a severe problem. Vehicles of all types were permitted in until the roads, parking lots, and campgrounds were overflowing. The result was a chaotic situation during many days of the summer or any high visitation season. Traffic jams on busy days were unbelievable. Smog blurred the very scene the visitors came to enjoy. Noise, which virtually eliminated the joy of natural sounds, or the tranquilizing effect of silence, was everywhere.

Today, the roads in the Upper Valley have been closed to traffic and a free shuttle bus service transports the visitor to various points. These buses are equipped with propane engines to reduce the sound and the smog. Anticipated criticism has been minimal and for the first time in many years an individual can feel the magnitude of that Valley in an atmosphere of singularity. After all, no one wanted to see Yosemite one vast campground.

Take as an hypothetical example, the integrity of an historic site which represents the life and efforts of one individual. He was perhaps noted for scientific contributions, perhaps for his political life, perhaps for humanitarian ideals, but nevertheless an individual of international importance. Because of such stature we have set aside his home or his land to allow future generations the opportunity to visit, see, and feel for a moment what that place is all about, and in some way relate the significance to today's world. To preserve,

restore, and interpret the area, research must give us the information needed for appropriate utilization. Structural fitness for anticipated visitation is of prime importance.

A total development plan must be prepared to prevent future use problems including controlling numbers of visitors. This plan must be developed to preserve the historic integrity of the site through appropriate interpretation designed to reach individuals rather than great numbers.

These are but two examples of utilization of current research necessitated by, as all of us well know, the population explosion, the tremendous increase in leisure time, increased mobility, constant advertising, intentionally, or otherwise, of our national landmarks. All have placed pressures far beyond our expectations on nearly every natural, recreational, or historic area. This is truly a challenge to all public land-use agencies in North America, as well as to the National Park Service. We suddenly realize that time is running out on us. Unless we are very careful, we are going to upset that natural balance and go so far in the wrong direction we will not be able to recover. One almost has a feeling of panic as he reads current periodicals and newspapers and listens to the television identifying the crunch in which we suddenly find ourselves. Despite all our care and efforts to develop parks for the greatest use, we have, in some instances, developed them for the greatest abuse.

These examples identify restricted uses as a result of man-made developments; however, we must consider, along with this, the ecological resource which presently exists. How has man affected that ecological balance? We can discontinue road building, or we may remove structures and other man-made paraphernalia, but if we have already destroyed ecological balance, we may very well be chasing an illusionary rainbow.

The Leopold Report of 1963 identifies certain species of animals and fish which have been extirpated from an area, and recommends restocking them where possible. One aspect of this problem is naturally, the predator, which in many cases, is one of the keys to balance. The Yellowstone elk problem has been partially attributed to the removal of wolves and mountain lions from the natural scene over the past years. There are those in the field who question this thesis and current research continues to probe the issue. Assuming however, some validity, then the result along with numerous factors, has been a phenomenal increase in the nonpredator population. This increase has been so profound that much of the scene today has changed and the visitor sees a modified environment which research says is a result of present overpopulation and overgrazing. This land will be unable to

maintain proper plant and animal life due to its total imbalance. Lacking appropriate data and understanding, we have also cut off migratory routes of many animals through road construction and population centers in critical passageways. We have, for the enjoyment of the visitor, stocked nonnative fish in lakes and streams of our natural areas, resulting in the loss of native species which were an integral part of the biome.

Citing still another example of our destruction of an ecological balance, inadvertently, but nevertheless real, National Park Service Chief Scientist Dr. Robert M. Linn has reported a problem with the sand dunes in our beach areas. Over the years we have attempted to stabilize the dune structure by planting beach grass and the use of other artificial means to prevent their total erosion as well as to prevent destruction of land behind the dunes by overwash. We now realize we have literally caused an unnatural erosion of the front beach at a much more rapid rate than took place years ago. We have stopped the natural action which was necessary to continue the normal, ecological balance of this region by preventing overwash including water, sand, and sediment which actually maintained the dunes as well as the area behind them. The water which fed plant and animal life in the brackish-like ponds has been cut off, and they, in turn, are disappearing. As a result, we are continually changing this biotic zone in some areas, and in fact, have hastened the destruction of the very thing we are trying to preserve. Ironically, this has all been done for the benefit of future visitors.

I cite these cases as illustrations of concern and experiment in our ecological history; all of which have been partially based on past theory of management and protection to facilitate use of an area by more people. We believe we have proven the need for a new and continued, innovative and sensitive management, utilizing all knowledge available for implementing restrictions which are acceptable, understood, and participated in by the public.

A massive education program is a necessity; one in which we talk intelligently and simply to the traveling public. Conservation groups already understand the need and all the meetings combined will not resolve the problem, "they simply talk to themselves." Their findings and recommendations must be communicated in a logical and acceptable way to the public.

What methods then can we introduce to restrict human use and how do we influence the public positively? There are many possibilities on the horizon which will indeed affect any visit to public land-use areas in the future.

There is little doubt mass transportation will be a major change.

Yosemite's experience was successful, but minor in terms of need and possibilities. Parking your car and traveling "in" to the area by bus, tram, rail, or foot will allow more freedom of movement and will naturally reduce smog, noise, as well as road and parking pollution. However, the automobile enthusiast is tied to his vehicle like Linus to his blanket; he has had many daily bad experiences with public transportation in metropolitan areas. As a result he may or may not be ready to accept the need for leaving his car outside the area he wants to visit. As our large metropolitan areas develop operable and comfortable "Disneyland" quality transportation systems, we too will be able to do so. In essence, we will not be restricting human use but rather will be allowing more space for visitor activity without destroying it.

We have, in the past five years, responded to the overcrowded camping situation. As the campgrounds in public-use areas filled to overflowing, we took action by closing all overflow campgrounds and identifying each camp site, thereby establishing a carrying capacity for that campground. A camping charge has also been levied in many areas. These actions certainly restricted the human use and as a result have allowed some recuperation of the land and soil. As would be expected, commercial campgrounds have been developed in the surrounding private sectors supporting the local economy while reducing the overuse of land within the park. With this kind of control, it has been possible to close several camping areas for recuperative purposes, thus getting campgrounds on a rotational basis. Grand Canyon, Mesa Verde, and Rocky Mountain have experimented with this method and without doubt others have or will utilize this balancing style of use.

Fortunately or not, the restriction on public campgrounds plus the increasing desire to get away from the heavily used campgrounds, has caused a tremendous impact in back country camping and hiking. Three experimental parks, Rocky Mountain, Great Smoky, Sequoia-Kings Canyon, were designated a year ago as pilot parks for testing back country use restrictions. These programs were successful to a large degree, but lack of manpower and trail-head controls prevented maximum utilization of the system. Current meetings are developing further implementation in this field with hopes of raising the level of compliance to an acceptable point, perhaps as high as 90 to 95 percent.

Maintenance management also plays a significant role in utilization of any area. A high level of maintenance including appropriate preventative measures assists the land in tolerating more use without abuse. Money and manpower definitely affect this program; however, the introduction and utilization of groups such as the Youth Conser-

vation Corps and the Student Conservation Corps have not only assisted in the actual maintenance projects on trails, streams, lakes and buildings but have also affected attitudes and preservation values of these young people. There is little doubt the multiplier effect of their new understanding of preventative maintenance and restricted use will be passed to many others in their age group. Involving youth in this active way will, without doubt, reap untold benefits in the future through understanding and acceptance of positive and necessary actions even though these actions may be diametrically the opposite of past social attitudes and use.

It would seem the simplest answer to restriction would be the total reservation system. Certainly if we were to control total visitation, our major problems could be resolved; however, this is not a simple matter. Equity and fairness in who can visit an area each year poses a real problem. Distance—lottery—first-come, first-served—all are means of choosing. But what about the local buff, the once-in-a-lifetime trip for a family, the annual visit or pilgrimage to a family's "favorite place" which have been found to be valid and large segments of an area's visitation? The area is, by congressional mandate, owned by the public, and telling them they may not enter is difficult, to say the least. Until such time as the decision is made on this massive action, we must continue to find other ways of utilizing the reservation system.

Mesa Verde, for example, requires a reservation for tours of the fragile Indian ruins called Balcony House and Cliff Palace. Tickets are given free on a first-come, first-served basis, allowing no more than 75 persons on each half-hour tour rather than groups of up to 170 persons every 20 minutes as was the case previously. When the day's supply of tickets is gone, tours are ended for the day, and believe it or not, many visitors who changed their minds and chose not to use their tickets, went out of their way to return them so others could take the tour. Complaints? A few at first, but by the end of 1967, it is reported there was not a single written complaint. This has been most successful since the visitors can at least see Balcony House, Cliff Palace, etc., from a distance, and they have not been denied the total experience.

Many parks have interpretive activities including hikes, night prowls, and formal programs which require a reservation to attend simply because the program can function only with a given number of persons. The boat to Isle Royale has a capacity which limits the number to that wilderness isle. Several areas are accepting, in fact, requiring reservations for campground space, with studies aimed at a computerized reservation system similar to that used in California state parks. This latter tends to restrict total visits by causing those

unable to confirm reservations to change travel plans. Interestingly, these reservation-required activities have been successful and have helped create an understanding of the need. Those participating have received a more valuable experience and are anxious for others to have the same opportunity. It has become a functional part of the education process so necessary if any of our restriction programs are to succeed.

A new and innovative concept is the use of Service-produced evening television programs beamed at the nearby hotel-motel units. They consist of a pre-taped interpretive and informational program and a daily updated portion presenting current weather, road, crowding and camping conditions as well as other pertinent data for the benefit of the potential visitor. The objective is to disperse visitors to lesser used areas, answer the repetitive questions and perhaps "lubricate" the visit, making it smoother, less time-consuming, and still a valuable and memorable experience.

As I mentioned earlier, education, understanding, and commitment are the keys to success, therefore everything we do should be developed with these in mind. Contacts in the urban community with assistance as requested in resolving their overuse problems will create an atmosphere of understanding and cooperation for similar problems in large public use recreation areas. Programs in Washington, D.C., New York, Phoenix, Seattle, and other large metropolitan areas are accomplishing this now, with federal personnel involving themselves in community and local environmental related programs resulting in restricted, but more valuable use of precious green spots, green belts, and historic buildings.

The segment of the population which will represent our salvation is youth (elementary through senior high school students). They will be the guardians of the future. Today, many of these minds are socially and environmentally tuned to the mechanical, concrete and push-button world of the city and its environs. Don't misunderstand, I said tuned in, not locked in, for actions have indicated their vibrant and enthusiastic support for helping improve everyone's lot. Federally sponsored programs such as NESA (National Environmental Study Areas) and NEED (National Environmental Education Development), are giving thousands of younger minds the opportunity to participate in activities designed to better understand the total environment. One result is a growing commitment to resolving many of the problems discussed in this paper.

CONCLUSION

This is what it is all about. There is great cause for discussion and action on restricting human use of public lands in North America.

We're not cognizant of all the solutions nor all the problems; therefore we must increase our research as evidenced by the execellent presentations at this conference. They dramatize the need for innovative methods while we have time. I believe all of these things are being done, perhaps in the minds of some too slowly, and yet time is a never ending quantity—it goes on forever. All we as human beings can do is utilize it constructively and aggressively. As far as natural areas are concerned, nature has a unique way of healing the wounds of man. But it, too, takes time and is a slow process. I suggest that regardless of what we do, natural forces will eventually take over and another balance will take place. It could be without man. We need to introduce our best thinking and actions to become a viable part of the system. Man belongs—he is not an outsider looking in, but rather a part of the ecological balance. Self restriction through understanding of all mankind's needs could well be the answer.

Perhaps Rachel Carson's *Silent Spring* or Stewart Udall's *Quiet Crisis* are excellent examples of the initial thrust which was needed. I quote from *Quiet Crisis*:

> What does material abundance avail? If we create an environment in which man's highest and most specifically human attributes cannot be fulfilled.

It seems this quotation is a summation whether we're speaking of natural, historic, or recreational land use. It indicates a need to know how many people a certain area of land will accept before it is destroyed.

Developing the "carrying capacity" of any structure or land is a nebulous and evasive statistic and yet vital to accomplishing the restrictive use we speak of. We have scientifically decided in the past that an acre of land will provide for X many cattle, that Y is the sustained yield of an acre of forest land, but we have not been able to decide how many people can use a given acre of land and receive the optimum good from it without damaging the resource or the esthetic satisfaction of the visitor. Fortunately we are getting close—we may end with arbitrary figures in some cases, but at least this will be a foundation upon which to build our public land-use patterns and management principles.

LITERATURE CITED

Advisory Board on Wildlife Management appointed by the Secretary of the Interior: Leopold, A. S., Chairman; S. A. Cain; Clarence Cottam; Ira N. Gabrielson; and Thomas L. Kimball.
1963. Wildlife management in the national parks. Reprinted from *American Forests*, April. (Magazine of the American Forestry Association.)

Alldredge, Rendel B., National Park Service
1972. Public use capacity and rationing for federal parks, recreation areas and facilities. May.
1972. Some Capacity Theory for Parks and Recreational Areas. July.

Cahn, Robert, Council for Environmental Quality, Washington, D.C.
1968. Will success spoil the national parks? A series reprinted from the *Christian Science Monitor.*
Cheek, Dr. Neil, Research Sociologist, National Park Service.
1970. Today's park visitor—Who is he and what facilities does he need? Included in *Proceedings of Recreation Management Institute.* Texas A&M University, College Station, Tex.
1972. Variations in patterns of leisure behavior—An analysis of sociological aggregates. Burch. William R. Jr., et al, *Social Behavior, Natural Resources and the Environment.* Harper and Row.
Held, Dr. R. Burnell; Brickler, Stanley; and Wilcox, Dr. Arthur T. Colorado State University, Fort Collins, Colorado. (The Center for Research and Education, Estes Park, Colorado)
"A Study to Develop Criteria for Determining the Carrying Capacity of Areas with the National Park System." November 15, 1969.
Sagan, Marc, Chief Interpretive Planner, National Park Service.
1970. Interpretive planning, in *Proceedings of Recreation Management Institute.* Texas A&M University, College Station, Texas.

DISCUSSION

DISCUSSION LEADER HERBST: A very excellent paper. Tom did a very fine job of pointing out the twofold objective of the National Park Service which is to conserve and preserve, but at the same time fulfill their commitment to the public for service. He outlined well the problems and conflicts which arise, and the increasing problems which are coming about.

He pointed out potential solutions that they are trying, and the most important point was the education necessary for the resolving those problems.

WALTER SMALLEY (Member, Washington Film Council): I like this gentleman's paper so well that I wonder if, in connection with education, he has made a film on this restricted use. If he hasn't, I'd be glad to suggest individuals who might be interested.

MR. THOMAS: We are working on films that we hope will put this message across in the schools. Our film group at Harpers Ferry designs them.

However, we would welcome any recommendations that you have because we, too, seek the outside viewpoint. Frequently, when we look at our films we see what we want to see; and when we get an outsider's point of view it's a different one, and a very good one.

MR. SMALLEY: Well, maybe I will suggest to some of the members of the Washington Film Company to invite you down for a luncheon of ours and share input.

MR. THOMAS: I'd love to.

MR. SMALLEY: Thank you.

EVERETT DOMAN (U.S. Forest Service): The problem of human use in national parks that Mr. Thomas points out is also characteristic of some of the favorite national forest areas in the United States.

One of the reasons that the people have not yet complained too bitterly about some of the restrictions like those in Yosemite is that they have overflow areas in the adjacent national forest and state parks in California where they can camp. But the problem is very rapidly becoming serious in the Stanislaus National Forest and in Calivera State Park. When the time comes, and it's not going to be very far in the future, that the Forest Service and the State have to put on similar restrictions, we are going to get violent public reaction.

This points out the need for all land management agencies managing these recreational resources to get together in an overall plan for all the recreation land in the area.

MR. HERBST: A very good comment.

HENRY NICHOL (Outdoor Leadership School, Lander, Wyoming): I would like to affirm everything that has been said about the need for education.

Without education we won't have any continued use of our wilderness areas. This National Outdoor Leadership School is pioneering in new techniques of conservation education, training people how to enjoy the outdoors, and at the same time preserve them. They are not only educating people, but they are carrying on

research in new techniques on how to camp and move through the great outdoors without harming it.

MR. THOMAS: The National Park Service has implemented a fantastic program called NESA and NEED. It's the National Environmental Study Area, and the National Educational Environmental Development program where young people actually go to a natural area or a historic area from an urban situation, and for a week their entire school curriculum is produced right there. It's phenomenal, the growth that takes place in these young people in understanding because it has been a meaningful tool to learn their math, and their history, and their science; and, believe me, parents learn as much when they get home.

GEORGE HUBER, (Washington, D.C.): I am a writer on outdoor subjects.

When he said restrictions are being accepted by the public, and that there are few or no complaints, I'm afraid he does not listen to the same persons I listen to. He said later that organizations such as this have the tendency to say the same things to each other and nod, and say, you are right. We are not right; there are many complaints, particularly from persons who use recreational vehicles.

Now, I'm not saying these persons are correct, but I go camping with them, I talk to them and I listen to them, and they are bitter about the crowded campground conditions and the restrictions put upon them.

Now, I'm not taking their side; I am saying they are not accepting it. Their complaints are that the campgrounds provided for recreational vehicles are crowded; the suggestion is that they make smaller ones.

I realize the management difficulty of smaller, 20-site camp-grounds over the two- to three hundred-site camp-grounds, but the suggestion is that many small campgrounds have less impact on the environment than those large camp sites. They give the visitor a greater outdoors experience.

Another complaint, particularly against the national parks, not so much against the national forests, is the small area of land belonging to the national parks that is easily accessible to the public. I hear figures of less than one percent.

We have horseback riders and back-packers who get into that country, but the average citizen can't; that is not so much in the national forests, as in the national parks. The complaint is that there is an elite of strong young men and women who go there with their packs on their backs, and that no land is readily accessible to the average person in his automobile.

I remember when Skyline Drive in Shenandoah National Park was projected in the 1930's, there were protests about Skyline Drive opening up these mountains. Actually Skyline Drive was built to provide work for people, and there were complaints about that—now Skyline Drive is one of the great recreational facilities of the Eastern United States.

Now, the things I have said are not meant to be arguments in rebuttal to some of the things you have said, but I am talking about what I hear with my ears to the ground when I talk to these people.

MR. THOMAS: I can't agree more that those kinds of complaints are heard every day. What I was getting at, when we get complaints, is that we have to have an appropriate alternative that will satisfy.

Certainly, if we had manpower, 20-site camp areas would be far more appropriate. Today's complaint of the Skyline Drive is: "Why don't you cut down all the trees? You can't see anything." This goes back to a lack of understanding.

But your statements on complaints are true. I cited only those few examples of restricted use, where through an appropriate public relations program we have been relatively well accepted, and specific things we have done have not generated complaints.

The other complaints we are still trying to resolve.

* * *

DEVELOPMENTS IN RECREATIONAL USE OF PUBLIC LANDS AND WATERS

LYNN A. GREENWALT
Bureau of Sport Fisheries and Wildlife, U.S. Department of the Interior, Washington, D.C.

Perhaps the most obvious recent development in the use of public lands and waters in the United States for recreation is the steady increase in the number of users. There are more people; of those people a greater percent have more leisure. It is the sort of continuing phenomenon that is related to a rising Gross National Product, a reflection of the general "goodness" of the times, a direct result of this nation's efforts to make more of everything available to even more people. This is the recitation we have all heard many times. It is a fine generalization, it makes grist for countless speeches, and it may even be accurate. However, it is a fact that more and more people are taking advantage of recreational opportunities offered by the public lands and waters of this country. If one aggregates all the annual public-use figures assembled by only the federal land-management agencies, the number is an awesome one amounting to several times the population of the United States. It is clear evidence that public use is on the rise, bringing with it the kinds of problems that are the origin of most of the new developments in recreational use which I will discuss.

Recreational use of public lands in the United States is as varied and as diverse as are the lands available. At the federal level alone these lands are managed for a number of reasons by many agencies, having as a common bond the fact that these lands and waters lend themselves to recreational uses of one kind or another and to one degree or another. The roster of these federal agencies is impressive: The Bureau of Land Management and its millions of acres of public domain lands in the west; the Forest Service, encompassing vast holdings throughout the nation; the Corps of Engineers and Bureau of Reclamation, both offering recreational opportunity as a part of their primary missions; the National Park Service and its priceless array of unique and distinctive areas; the Tennessee Valley Authority and its waters in the populous Southeast; the military agencies, which can and do provide limited recreation on their lands; and the Bureau of Sport Fisheries and Wildlife, which contributes directly and indirectly to recreational potential with its system of national wildlife refuges. There are also the hundreds of thousands of acres of public lands in state, county, and municipal ownership, many dedicated primarily to public outdoor recreation.

The users of these lands—and their own special concerns and interests (and sometimes biases) are as varied as are the lands and land-managing agencies. There are the general recreationists who want only to get out-of-doors and enjoy that re-creative and too often unprivate experience; there are the strict preservationists, who hope to see vast areas of land and water kept free of exploitation, sometimes including most forms of recreation. And in between there is the broad spectrum of people who are interested in doing their own particular thing. All these uses are not always compatible. Interests are frequently at variance and conflicts of interests—not to mention the uses themselves—are inevitable.

This state of affairs is complicated enough, but is made even more labyrinthine by the fact that much of the public land and water in the nation is also dedicated to relatively limited purposes.

As an obvious example, military lands are intended to contribute to the defense of the nation—recreational uses must be given a priority that is often so low as to be virtually unrecognizable. Lands and waters in the National Forest System and the public domain administered by Bureau of Land Management are dedicated to the proposition of multiple use, with all appropriate uses being recognized and accommodated with a minimum of conflict. Even so, as any District Ranger or State Director will tell you, conflicts are inevitable and often difficult to resolve. Combine these real-world problems with the conflicts between the wants and needs of users, and it is clear that the genesis of most land-use and land-management decisions and developments of the last few years has been related to the resolution of conflict.

Perhaps the best way to shed light on the state of the art today is to relate it to one agency which represents in a mercifully modest way the universe of land and water-related recreational management, its problems, and the general course being followed in solving those problems. My own agency, the Bureau of Sport Fisheries and Wildlife, is one which, through its National Wildlife Refuge System, is representative of the problems faced by today's administrators and managers.

The National Wildlife Refuge System includes 30.5 million acres of land in almost 350 units situated in every state of the nation except West Virginia. It embraces wildlife habitat—and recreational opportunities—of every description. Because of its relatively narrow purpose—the preservation and enhancement of wildlife and its habitat—the System also carries with it the certainty of conflicts.

In spite of a purpose which would seem to exclude many kinds of recreation, the Refuge System includes lands and waters theoretically

suitable for almost every kind of outdoor recreation, thus attracting all the kinds of use demands which might be expected to apply to any kind of public land, regardless of agency responsibility.

It is not appropriate to recite all the kinds of conflicts of demand and interest that affect the Refuge System. Suffice to say that the System experiences conflicts between purposes and interests as diverse as whooping cranes and oil pipelines, between hunters and those who find hunting reprehensible, between boater and fisherman, snowmobiler and solitude-seeker, between developer and preservationist—in short, just about every permutation of conflict imaginable can be identified at some place or at some time in this national system of lands.

Here, too, can be found the evidence of the varying ways these conflicts are being dealt with—the new developments I feel to be among the most significant in the area of recreation on public lands and waters today.

One of the most dramatic—and potentially most wrenching—conflicts now on the scene concerns the proper use of off-road recreational vehicles, or "ORRVs" in the argot of the trade. These vary from snowmobiles through go-anywhere motorbikes and highly mobile amphibious devices, to jeeps and slightly modified conventional vehicles, like dune-buggies and beach cars. The use of these popular vehicles has developed a polarity of partisanship that has been unequalled in the history of land-management. Almost no one is neutral; there are the single-minded devotees of snowmobiles and those who would like to see them consigned to the most remote and snowless corner of the nether world. Even the wrath of the woman scorned cannot match that of the wilderness hiker overtaken by a 400 cc trail bike. In these circumstances there seems to be practically nobody who is not passionally advocate of one position or the other—the "grey area" of neutrality is ominously unpopulated.

The problem of conflicting interests has been addressed on a broad scale by an Executive Order which at once—and quite properly—recognizes the need to provide for the use of ORRVs and yet regulate them in such a way that conflicts between uses and impacts upon the land and its resources are minimized. The Executive Order directs each land-managing agency to identify those areas on which these machines can be used and to establish controlling regulations for their use. These regulations must relate to licensing, noise factors, times and places of use, and other matters important to the safe and proper use of these machines. In essence, the Order assures the recognition of the recreational value of ORRVs, but also directs that these uses will be made in such a way as to avoid conflicts with other proper uses of

the land. The national parks and national wildlife refuges are not compelled to accommodate the use of ORRVs, though their uses on these areas can be permitted, providing it is determined that the use of ORRVs will not conflict with the basic purposes of the park or refuge.

It is clear that Executive Order 11644 does not itself resolve these basic conflicts; it provides only the mechanism by which the resolution can be effected.

Another problem that has moved into the forefront of recreational management in recent years is the conflict between demand for recreational opportunity and the ability of the resource to accommodate that use. This is further conditioned by the funds and manpower available to the agency for the management of public use. Federal agencies—and the lands they manage—are in danger of being "loved to death" by the users they serve. People come to national wildlife refuges, for example, because they like what they find there. A cruel irony often ensures, however, when the number of people finally decrease the attractiveness of the experience to the point where the basic values which enthralled the visitors in the first place are no longer attractive. Too many people enjoying the solitude of the beach at Parker River Refuge in Massachusetts destroy the solitude, drive away the sea and shorebirds and soon erase the recreational value of the area. Like many another public land-managing agency, we are too often overwhelmed by our own clients—and the resource for which the refuge was established is the loser. These unhappy and unwholesome situations are faced by other organizations as well. It is a sign of the times—a clear indicator of the demand for public recreation on public lands. It is also an equally clear symptom of the need to do something about it. In the case of national wildlife refuges, we have determined that the relationship between recreational demand, our ability to provide for it, and our obligation to the wildlife and wildlands resource for which we are responsible has gone awry. We cannot continue to permit and encourage recreational uses that make it more and more unlikely that we can continue to manage the lands for the purposes for which they were set aside. Even so, we also recognize that these lands are meant to be of benefit to people. We have, then, reassessed the priorities—reordered the purposes, if you will, and have taken steps to get things back into proper perspective.

In doing this we have employed the same devices adopted by other land-management agencies. While the process is complicated, the principle is a simple one: we have determined what the objective of the management of each refuge unit should be and then set about to attain those objectives in a way that provides the best assortment of

benefits that can be derived from the use of that land, considering dollar and manpower constraints. It is the application of management-by-objective to the administration of public lands and waters. It is a technique developed with the unique values of the land, the special obligations to the wildlife resource and the mandates of the people all fully considered. An otherwise formidable job has been made somewhat easier by a Congressional determination that in all instances wildlife and its habitat on national wildlife refuge lands must have first consideration; public uses must come only as a secondary consideration and then only when it is clearly evident that those uses will not affect adversely the welfare and well-being of wildlife and its habitat.

As a result, we have determined that all public uses not directly related to wildlife and wildlands must be curtailed and eventually discontinued. Such uses as swimming, water skiing, recreational boating, recreational camping and picnicking no longer have any place on national wildlife refuges. We have determined that public uses related to environmental education, interpretation and understanding of the natural values of these lands, and hunting and fishing will be accommodated, but only to the extent that they do not impinge upon the basic values of the areas. Further, the providing for these kinds of uses must not pre-empt funds and manpower needed to carry out the primary mission of the National Wildlife Refuge System. These decisions have resulted in what has become—to use a term once popular in the world of international diplomacy—an agonizing reappraisal of where we are and where we are going.

The general approach is being taken by our sister land management agencies as well. The National Park Service, an agency representing the finest recreational management skills in the world, has taken a similar look at the way it does much of its recreational business: the exclusion of cars from some national parks, and the limitation of visitation to units of its system are examples of that organization's efforts to cope with this fundamental conflict.

The Bureau of Land Management has developed an effective land-use planning system based upon the identification of potential land-uses related to the fundamental ecology of the area. This Management Framework Planning process is enabling Bureau of Land Management managers to identify and resolve conflicts during the planning process and prepare orderly and rational land use proposals that meet the needs of their multiple-use philosophies.

These examples set forth another of the far-reaching developments in the area of recreational use of public lands and waters: the use of carefully structured, goal-oriented planning processes to develop a national long-range program.

Another major development in recreational use of public lands and waters is one having a growing influence on the conduct of these programs. It is not a recent one, but it is steadily growing in importance and influence. I refer specifically to the interest and active participation by the public in matters related to the user of public lands. It reveals itself in many ways—not all of which are received with delight by public land administrators—but it more and more clearly indicates what the public desires be done with its own resources. Only the shortsighted and insensitive public official regards this kind of public interest as interference. It is, rather, an expression of the fact that the public will no longer stand idly by and permit public land managers to do what they wish with the public lands and resources entrusted to them. Active public interest forces the land manager to plan well, consider the consequences, and to strive diligently and unceasingly to do his job properly. The public has found the effectiveness of the courtroom in making sure that the public administrator does not go astray in his actions; protest and public hearing and petition are all employed effectively.

Yet another expression of concern and interest by the public has become more in evidence. Private citizens and businesses have put their resources where their interests are by donating valuable and unique tracts of land to the public. Perhaps the most generous gift of this kind in the history of the country was made recently when a New Jersey based timber management and paper manufacturing concern, the Union Camp Corporation, gave 50,000 acres of its Dismal Swamp, Virginia, lands to the United States to be managed by the Department of the Interior as a national wildlife refuge. Many other smaller, but equally public-spirited donations have been made to the Refuge System, to the National Park System, and to other federal and state organizations. This growing trend is reassuring to all of us that the public is, in fact, vitally interested in the future of recreation, natural resources, and the quality of life.

A related development—public interest as reflected in Congressional action—indicates the advance of concern for the nation's natural resources and their recreational potential. The Alaska Native Claims Settlement Act, recently passed, not only recognized the Nation's obligations to a long-neglected element of its citizenry, but in the process assured the preservation and proper use of one of the last remaining reservoir of natural resources in North America. This Act will assure the retention of 80 million acres of Alaskan natural resources, to be included in one of four principal land-management systems: The National Forest, National Park, National Wildlife Refuge, or National Wild and Scenic Rivers Systems. This will

provide for a national land preservation effort unparalleled since the days of President Theodore Roosevelt and Gifford Pinchot.

Recent amendment of the Land and Water Conservation Fund Act has made possible the use of this source of funding for preserving large blocks of land vital to the preservation of endangered wildlife species and to set aside lands for special purposes related both to resource management and to recreation. The Marine Mammal Protection Act provides the vehicle for protecting a valuable part of the world's wildlife resource and thereby indirectly polishes a facet of the jewel of public recreation. The probable passage of a national land-use planning bill in this Congress presents the potential for assuring the recognition of the need for recreation based upon having lands and waters available for this purpose.

These developments in matters related to recreation using the public lands and waters of the United States serve to underscore the idea that recreation is important; that the public lands of this country are important to recreation; and that the thrust of national concern is steadily moving in the direction of improving the opportunities to engage in outdoor recreation provided by an enlightened, sensitive, and concerned cadre of professional land managers working with the people they serve to provide for the needs of the people in balance with the needs of the varied resources in which those same people are justifiably interested and concerned—for now and into the future.

DISCUSSION

DISCUSSION LEADER HERBST: Thank you, Lynn. You mentioned snowmobiles, and I can't help but share a few comments since the Minnesota area has a few. That's one of the most dramatic conflicts in recreational pressures that we have in our state. About seven years ago we hardly had any snowmobiles; now we have well over 350,000 in our state alone. There are some two million in use on the North American continent, and it has changed the recreational picture.

For example, in the last five years we have built more than 3,000 miles of trails for snowmobiles; our conservation officers have to spend about 20 percent of their time in the winter on snowmobile laws; it has made the winter enjoyable for a lot of people who previously never used the winter in the State of Minnesota. At the same time we have had snowmobiles use muskrat houses as launching pads, and we have had vandalism and many other problems. But the most significant problem that we have, and the one that we are vitally concerned with in our state, is safety—the accidents.

Surveys in our state indicate that one out of every 25 machines is going to have an accident involving medical attention, or $100 in property damage. You can compare that to firearms use where the accident potential is only one in 2,000. In 1972 we had 33 people killed by snowmobiles, and more than 7,000 required hospitalization or medical attention. In fact, some hospitals in our state had as many as 40 on a weekend hospitalized because of snowmobiles. So we have a very critical challenge of balancing the desirable uses, but at the same time regulating the problems, and perhaps most important, stressing education for the safe handling of this vehicle.

ROBERT DENNIS (Conservation Foundation): About six months ago we completed a year-long study of the national park system, a citizens survey.

First, as to what Mr. Thomas had to say. Where we had a chance to have citizens representing many diverse interests, educate themselves about some of the pressures and problems, there is a remarkable degree of consensus and understanding of what the problems are, the issues, and what some of the answers may be.

What we tried to do was to ask people to take a look 50 years down the road, at the trends over the last couple of decades, and ask themselves what they really wanted the national parks to be like for their children and grandchildren in, say, 50 years. Once they had gone through this exercise, we brought them back to the present and asked them what policy decisions they thought had to be made today in order to achieve that result.

In that kind of context we were, frankly, quite astounded at consensus among the recreational vehicle owners, the backpackers, and everybody else, about the need for limitation of one kind or another upon their use of these public facilities.

In connection with this study we got in a couple of questions that came up again this morning, a number of issues and the very essential ones, one of which Mr. Herbst has mentioned.

Really, the critical question we have today is whether or not anyone has the God-given right to use whatever technology can advance and whatever he can afford in every kind of place and time he chooses. That is a fundamental question that really resource managers have not dealt with heretofore, and we are going to be forced to if we continue to have more people and more technology. We are going to have some very fundamental policies in this area. What kinds of decisions does the private individual have the right to make for himself?

For instance, the question facing the demand on public land then must be whether or not recreational vehicles ought to exist and how they ought to be used in the context of public lands. Here again it was the finding of our study in regard to national parks that the use of these things ought to be restricted by and large to areas around the parks.

If you look at the impact of these vehicles on what must be new road standards, facility standards, and levels of public investment, that makes a pretty convincing argument. I don't think in the process, as some have charged, that you rule out the use of these public resources by the too old or infirm. You have to use them in different ways, using public transportation, for instance, rather than their own automobiles.

In fact, one of the people who participated in our study said he thought that there would be a lot more octagenarians using the national parks if there were some sort of organized public transportation system and they didn't have to drive their own cars around corners next to the cliffs. So we will be seeking new policies with respect to use of our technological thinking.

MR. HERBST: Thank you, Bob. You put your finger on a critical point. I always like to relate it to the Bill of Rights, which I believe doesn't grant all of us unlimited rights at the expense of society itself. I think that the Bill of Rights is also a bill of obligation.

EDWARD LANDIN (Minnesota): We have talked about the necessity of education, and we have also talked about the public pressure on lands. If we get into what now is being popularly talked about, environmental education, which is a little more formalized participation-type program involving the kids in schools, that's a tremendous population of new users.

Is there any consideration of what kind of impact environmental education will have on the use of public lands?

MR. GREENWALT: There are two things to consider in what Mr. Landin has asked. First of all, there is the presence of lots of youngsters on public land, but more importantly, there is the impact of what those youngsters will have learned in their environmental education. It is hoped that the process of environmental education will give a better understand and will make more properly reactive citizens of these youngsters.

The Environmental Education program being conducted by the National Wildlife Refuge System is designed primarily to give school-aged children an exposure to the environment in an essentially learning setting. We provide the land, the teacher

provides the children and the experience. The concern is not so much about hordes of youngsters on the land, because that doesn't happen, but more importantly what these young people will do when they become responsible citizens; they are the guardians of the resources in the future.

So, it is my opinion that this kind of impact momentarily is negative, but on young, healthy children the environment must have some kind of impact in the time to come, and that will most salutary, I am certain.

MARTHA REEVES: We have two philosophies here represented; Mr. Thomas' philosophy that the National Park Service evidently has a policy that a resource in the broad sense of land concept is the first consideration.

The slogan, "Parks are for people" assumes that parks must have as their fundamental purpose a population of people and that you must accommodate 20 million people in the New Hampshire area.

I submit that the Park Service must in some way enunciate a policy that the land resource is limited, but we have found that our human population is limitless, and in this context we must devise new policies that have not yet been enunciated by the National Park Service on the national level. The restrictions which have gone into place are not at really causive levels as yet, and these must come about.

ENVIRONMENTAL PLANNING FOR OIL SHALE PRODUCTION IN WESTERN COLORADO

ALEXANDER T. CRINGAN
Thorne Ecological Institute, Boulder, Colorado; and

PAUL D. KILBURN
Colony Development Operation, Atlantic Richfield Company, Operator, Denver, Colorado

INTRODUCTION

This paper discusses how results of an inventory and impact analysis study by an independent nonprofit research organization, Thorne Ecological Institute, have been used in the planning phase of a commercial oil shale industry. The paper examines the techniques used in this ecological study with particular emphasis on wildlife resources, illustrates how a major locational change in plant site was brought about for environmental reasons, and concludes that such study should be an important aspect of sound planning for similar industrial activities.

Colony Development Operation (Atlantic Richfield Company, Operator) has been engaged in research and development concerning the feasibility of developing a commercial oil shale plant since 1964. Studies included construction and operation of a Semi-Works plant on Colony's property, a privately-owned tract of 8840 acres, which is situated near the headwaters of Parachute Creek, to the northwest of Rifle, Garfield County, Colorado. The property is situated near the southern edge of the Piceance Basin oil shale reserves which are the richest and most extensive in this country.

The ecological study which is the subject of this paper developed

from an increasing environmental emphasis growing within Colony that recognized the importance of strong environmental consideration, along with technology and economics, in decision-making. This emphasis has resulted, just since 1969, in over eighty separate environmental studies at a cost of over two million dollars or about ten percent of the total project cost in that time period.

Early environmental effort began within Colony in 1964, (Hutchins *et al.* 1971) five years prior to Atlantic Richfield's joining the venture, with some early revegetation, air and water quality studies. By 1970 it had become clear that what at first appeared to be confined impacts were really features which affected the surrounding ecosystem. Clearly a broad ecological study was necessary, and an intensive inventory and impact analysis was developed. Details of the total program and the role of the Thorne study are described in a recent paper by Kilburn (1973).

The Parachute Creek drainage basin encompasses an area of about 216 square miles, is 18 miles long, and 12 miles wide. This basin is characterized by a central canyon 14 miles long, 2200 to 3200 feet deep, and ¼ to 1-½ miles wide, which has been cut into the Roan Plateau along its southern edge by Parachute Creek. There are three principal tributary canyons and numerous smaller gulches, in addition to the main canyon.

Elevations in the Parachute Creek Basin range from a low of 5200 feet at Grand Valley to 9200 feet at the eastern headwaters of Parachute Creek on the plateau. Mean annual precipitation ranges from 12 to 20 inches, and winter precipitation from 6 to 12 inches. Mountain shrublands, sagebrush and pinon-juniper are the principal cover types, together constituting some 85-90 percent of the vegetation. Trembling aspen, cultivated lands, Douglas fir, and riparian communities also are represented. Ferchau (1973) has conducted an intensive study of the vegetation of the Colony property.

Some 70 species of mammals and 258 species of birds either occur, formerly occurred, or reasonably could be expected to occur in the Parachute Creek Basin (Cringan 1973). In addition, at least 12 species of amphibians and reptiles and 13 species of fish are known to occur in the area (Pettus 1973).

Parachute Creek is included within Colorado's Big Game Management Unit #32 (Colorado Division of Wildlife). The mule deer is the dominant native mammalian herbivore of the area. The Parachute Creek Basin is adjacent to and immediately south of the Piceance Creek Basin, renowned as the habitat of one of the larger mule deer herds of the nation. Mountain lion, coyote, and bobcat are among the more significant carnivores of the watershed. Characteristic birds of

the area include a variety of raptors, with golden eagles being especially well-represented, and a few bald eagles occurring during winter.

Specialized canyon species such as the cliff swallow, white-throated swift, and chukar, together with typical species of the ecosystems, are represented. Cutthroat trout and rainbow trout are among the fishes of the system.

METHODS AND APPROACHES

Thorne Ecological Institute assembled an interdisciplinary team of professors and other professionals from throughout Colorado to conduct the inventory and impact analysis studies in the following component areas: geology, soils, hydrology, plant ecology, climatology, the aquatic ecosystem, invertebrates, lower trophic levels and disease vectors, cold-blooded vertebrates, terrestrial vertebrate fauna, scenic resources, recreation resources, and regional planning (Figure 1).

The general objectives of Thorne's inventory studies are:

(1) To describe the pre-development environment;
(2) To identify sensitive environmental components, and components considered to be critical by virtue of national or regional scarcity;
(3) To produce data for use in decision-making, fully compatible with those required by the National Environmental Policy Act of 1969 for major projects on public lands (National Environmental Policy Act of 1969).

Each member of the research team has conducted inventory studies within his discipline, using appropriate review and investigative techniques. Interdisciplinary viewpoints have been achieved through joint field studies, periodic group meetings, and other less formal procedures. Some inventory studies are being continued or expanded—snow, hydrology, wildlife, regional planning—as it has become clear that additional data are needed. Long-range mitigatory plans and monitoring plans are another outgrowth of the study. Such monitoring allows quick awareness of any variation in baseline conditions the plant complex may produce and allows quick attention to solving any environmental problems that occur.

Awareness of potential impacts implicitly guided early inventory studies, but actual impact analysis did not begin until the summer of 1972. The techniques used in this impact analysis were developed by the Thorne team and have been described by Alden (1972, 1973). Specific procedures include mapping of critical environmental com-

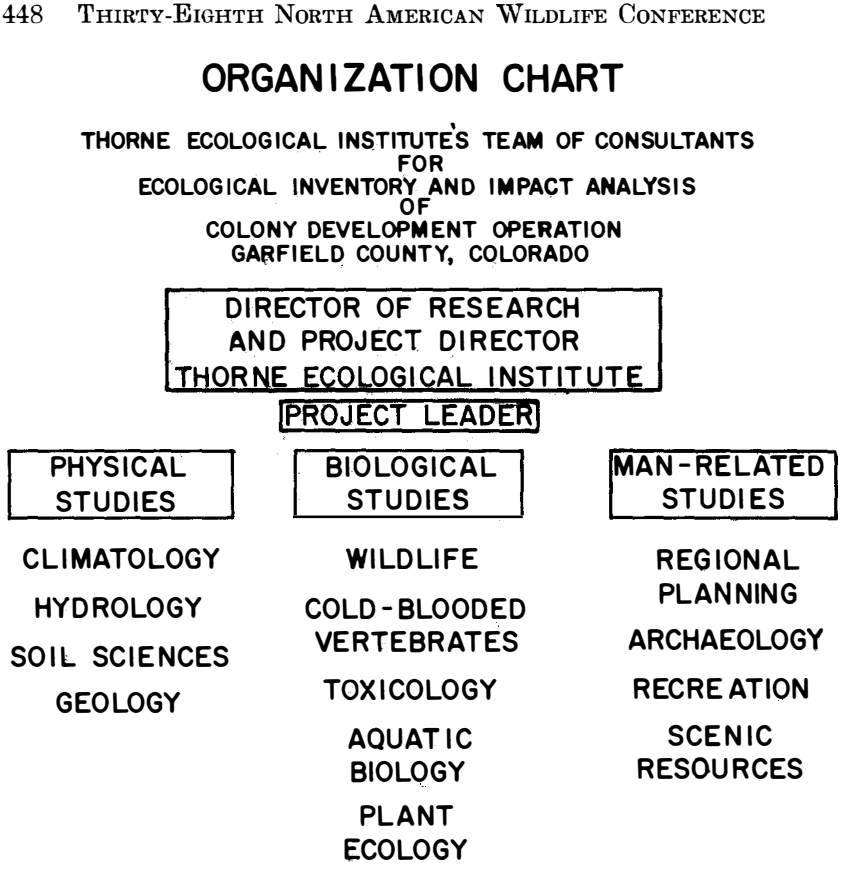


Figure 1.

ponents on overlays; construction of strength-of-relation matrices in which each environmental component or sub-component is rated as to its dependence upon other components; and predicted impact matrices in which the direction and extent of expected impact of a particular development alternative upon a specific environmental component is expressed. This permits the ready contrast of alternatives from an ecological viewpoint. Final steps in impact analysis are identification of environmental constraints, and recommendation of design criteria and mitigative procedures. All of these features are discussed in relation to wildlife in the next section.

Impact analysis required joint meetings of Colony's engineers and Thorne's ecologists, together with smaller, less formal discussions concerning specific problems between members of these two groups. These meetings initiated a continued exchange of information and

ideas between the engineers and consultants which allowed the ecologists to better predict impacts likely to result from specified development alternatives. They also allowed Colony to consider more fully the ecological costs along with the economic costs in the various parts of their proposed operations.

Colony has welcomed the assistance of state and federal agencies and participation of citizens' groups in the planning of its commercial plant. Notably, OSRPC, the Oil Shale Regional Planning Commission, COSEP, the Committee on Oil Shale Environmental Problems, and CORSIM, the Colorado River Simulation Model, have been supportive to Colony. Another group of particular assistance to Colony has been the Inter-Agency Wildlife Mitigation Committee, established late in 1972.

RESULTS

The results of Thorne's inventory and impact studies and of Colony's other environmental studies have led to some basic changes in the plans of Colony's potential commercial plant, along with many lesser modifications. This section emphasized how plans were changed as the result of one or more ecological study.

Perhaps the most basic consequence of the Thorne effort, in concert with other studies was a decision to change the plant location and processed shale disposal embankment. Originally, it was planned to place the plant on the floor of Parachute Creek Canyon at an elevation of about 6000 feet, at the confluence of Middle Fork and East Middle Fork, and to place processed shale in an adjacent embankment on the floor of East Middle Fork Canyon (Kilburn 1973). A number of compelling ecological considerations led to a decision to place the plant on the Roan Plateau, near the head of Middle Fork and to dispose of processed shale in Davis Gulch, a small headwater tributary. Among reasons for this major change of decision, which decidedly increases the economic costs of the project while decreasing ecological costs, are the following:

(1) It was predicted that the frequently-occurring inversions in Parachute Creek Canyon would be likely to trap emissions from the plant, contributing to undesirable ground levels of certain pollutants even though plant stack emissions were well within the required limits.

(2) It was judged that in the long-term post-operational period that will span centuries, the possibility of a flash flood occurring on East Middle Fork with 34 square miles of drainage could cause accelerated erosion and even threaten the stability of the processed shale embankment. There is little

possibility of this occurring in Davis Gulch, where little or no drainage area above the embankment exists.

(3) At present, winter range is more limiting than summer range to mule deer in this area; a plateau-top complex would eliminate less winter range than a canyon complex, and would interfere less with seasonal migrations of mule deer between their summer and winter ranges. The plateau location is a strong plus factor with regard to this important wildlife feature.

(4) The established riparian and aquatic ecosystems along Parachute Creek and its tributaries are among the more poorly represented communities of the valley; they would be modified far less by a plateau scheme than by a canyon scheme.

(5) The segment of East Middle Fork Canyon designed for processed shale disposal possesses unusually high scenic values and in addition, has a substantial educational potential, especially in geology, geomorphology, plant ecology, and wildlife ecology. Disposal in a plateau location would prevent modification of these important values.

Transportation routes, roads, required pipelines, and other service facilities, to the extent that they are under Colony's control (Kilburn 1973), are being designed so as to minimize environmental costs. Where feasible, roads are being located to reduce cliff-face damage that will minimize impacts upon eagles, mountain lions, bobcats, and other animals characteristic of the canyons. At present, studies of deer movements and distribution in Parachute Creek Canyon are being continued, with the objective of preparing recommendations on the design and operation of transportation systems between the plant and the surrounding area. The study will help to determine road locations, to show where underpasses, fences, and watering facilities should be built, and to aid in timing of shifts and traffic control, all in order to reduce the impact of the transportation corridor upon wildlife. Impacts upon wildlife, however, are only one of several ecological considerations used in developing transportation systems.

Despite any set of short-term mitigative procedures that can be applied to oil shale development, there will be some adverse environmental impacts on wildlife which will be unavoidable. For example, it is expected that sensitive and uncommon (in this area) wildlife species, such as the elk and mountain lion, will be very difficult to maintain near the industrial area. Similarly, some raptors may be difficult to maintain, at least in the immediate vicinity of the plant. However, it seems likely that most species of mammals and birds will

continue to occupy the Parachute Creek Valley, even if local populations may be displaced somewhat. It is expected that population reduction from this one plant will be minor and undetectable at the regional and county levels.

The reasons for this low detectability are that most techniques for estimating populations and other parameters of wildlife species are imprecise and characteristically generate estimates with broad confidence bands. Wildlife populations are continually responding to a wide range of independent variables, two or more of which could produce similar effects. Consequently, it may not be possible to detect change due to the plant except locally, and even if change is confirmed, it may not be possible to assign it to any one cause with certainty.

Certain positive impacts are anticipated, such as with commensal birds. Depending upon the parameter selected, expected impacts vary. For example, it is quite possible that mule deer in Parachute Creek Valley could be managed so as to increase harvest and decrease total nonretrieved mortality, both of which could be regarded as positive impacts. Through careful management of ecosystems and conversion of land use toward less animal husbandry and greater wildlife production, it is quite possible that positive impacts through increased populations of deer and of secondary consumers which feed upon deer could be achieved. In reality, it appears that a range of impacts can be expected. If society is prepared, the adverse effects of this particular oil shale industry upon wildlife can be reduced substantially, but only if efforts by Colony are supplemented by procedures and practices from outside groups acting in concert with this effort. In short, the degree of impact on wildlife can be considerably modified.

IMPACT ANALYSIS OF THE WILDLIFE COMPONENT

Results of the inventory studies, together with the overlay sets and strength-of-relation matrices, aided in identification of locally important sub-components of the wildlife resources. In general terms, economic, ecological, or aesthetic importance may lead to special consideration of a species, or group of species, in impact analysis. Also, rare species, critical habitats, and sensitive indicator species demand particular attention. In this particular study special attention was accorded the mule deer, important both for economic reasons and by virtue of its dominance among native mammalian herbivores; and the larger carnivores and raptors, which are important as secondary consumers and are of above-average interest to the general public.

Construction of the predicted impact matrices, in two distinct

steps, was an essential procedure in impact analysis. The first, general step was designed to express the expected impacts resulting from various mining and processing features upon broad sub-components of the wildlife resources. Four sub-components recognized were mule deer, raptors and carnivores, other mammals, and other birds. This procedure aided in the selection of an optimal development proposal, after considering expected impacts on wildlife and all environmental components. The second step was to predict the expected impact of the optimal development proposal upon a much larger list of wildlife sub-components, broken down into groups of species that were expected to respond similarly to developments. The difference in the two steps, then, was that in the first, the impact upon wildlife in general likely to result from each of a number of specific development alternatives was predicted. In the second step, impact upon specific wildlife groups likely to result from one particular set of development proposals was predicted.

The structure of the form used in this second step is shown in Figure 2. Wildlife was separated into 79 sub-components, 47 of mammals, and 32 of birds (Table 1). Subsequent judgments and predictions were made for each of these sub-components. Selected parameters, and methods and references, related to the major methods used in our inventory studies. Primary impacts were defined as being those resulting from events and processes essential to the project;

SUB-COMPONENT	SELECTED PARAMETERS	METHODS, REF.	KINDS OF IMPACTS		DIRECTION AND EXTENT OF EXPECTED IMPACTS									ENVIRON. BENEFITS AND COSTS	ENVIRON. CONSTRAINTS & DESIGN CRITERIA
					CONSTRUCTION			OPERATIONS			POST-OPERATIONS				
			PRIMARY	SECONDARY	LOCAL	INTERMED.	EXTENDED	LOCAL	INTERMED.	EXTENDED	LOCAL	INTERMED.	EXTENDED		
MAMMALS 47 SPECIES & GROUPS BIRDS 32 SPECIES & GROUPS 79 SUBCOMPONENTS CONSIDERED															

Figure 2.—Structure of detailed impact matrix for wildlife. Colony development operation, Garfield County, Colorado.

TABLE 1. WILDLIFE SUB-COMPONENTS WHICH WERE EVALUATED IN DETAILED IMPACT MATRIX, COLONY DEVELOPMENT OPERATION, GARFIELD COUNTY, COLORADO

Mammals of Regular Occurrence	
Shrews	Voles
Bats	Muskrat
Snowshoe Hare	House Mouse
White-tailed Jackrabbit	Western Jumping Mouse
Black-tailed Jackrabbit	Porcupine
Desert Cottontail	Coyote
Nuttall's Cottontail	Red Fox
Yellow-bellied Marmot	Gray Fox
Richardson's Ground Squirrel	Black Bear
Thirteen-lined Ground Squirrel	Raccoon
Rock Squirrel	Ermine
Golden-mantled Ground Squirrel	Long-tailed Weasel
White-tailed Antelope Squirrel	Mink
Chipmunks	American Badger
Red Squirrel	Striped Skunk
Northern Pocket Gopher	Mountain Lion
Apache Pocket Mouse	Bobcat
Beaver	Elk
Peromyscus sp.	Mule Deer
Bushy-tailed Wood Rat	

Mammals of Rare or Uncertain Occurrence	
Opossum	Spotted Skunk
White-tailed Prairie Dog	White-tailed Deer
Western Harvest Mouse	Mountain Sheep
Ringtail	Wild Horse

Birds of Regular Occurrence		
Loons, Grebes, Cormorants, Herons	Turkey Vulture	Charadriiforms
Accipiters	Buteos	Band-tailed Pigeon
Golden Eagle	Bald Eagle	Mourning Dove
Marsh Hawk	Prairie Falcon	Owls
Pigeon & Sparrow Hawks	Blue Grouse	Poorwill
Sage Grouse	Ring-necked Pheasant	White-throated Swift
Chukar	Gruiforms	Hummingbirds
Woodpeckers	Other Non-Passerine Birds of reg. occ.	Dipper
Rock & Canyon Wrens		Rosy Finches
Commensal Birds	Other Passerine Birds of reg. occ.	

Birds of Rare or Uncertain Occurrence (No sightings reported in last decade)	
Osprey	Peregrine Falcon
Wild Turkey	Other Rare, Accidental, or Irregular Species

secondary impacts were those resulting from events made possible by the project, yet not essential to it. For each of three periods of time—construction, operations and post-operations—potential impacts were developed. The impacts were at each of three spheres of influence: local (Colony property, including mine, plant, and shale disposal

site); intermediate (Parachute Creek Canyon, including transportation and utilities corridor), and extended (Garfield County as a whole). These initial predictions were for the maximum primary and secondary impacts expected, as if no mitigative procedures were to be undertaken, and as if the worst possible secondary impacts were to occur. In addition, impact predictions were made for situations in which mitigation measures were maximized. The column headed "Environmental Benefits and Costs" permitted expression of the principal operational means through which it is expected that impacts will occur. The last column, "Environmental Constraints and Design Criteria," allowed brief listing of mitigative procedures, which are expected to reduce negative impacts, or to further enhance already positive impacts.

Seven impact rating terms were used, as shown in Table 2. These

TABLE 2. DEFINITIONS OF IMPACT RATING TERMS APPLIED TO WILDLIFE IN IMPACT STUDY, COLONY DEVELOPMENT OPERATION, GARFIELD COUNTY, COLORADO

Symbol	Impact Rating Term	Definition
+3	High Positive	Increase in parametric value of 50% or more; should be confirmable within 3 years.
+2	Moderate Positive	Increase in parametric value of 25 to 50%; should be confirmable within 3 to 10 years.
+1	Slight Positive	Increase in parametric value of 10 to 25%; not usually confirmable within 10 years.
0	No Change	Increase or decrease in parametric value of less than 10%; not confirmable within useful period of time.
-1	Slight Negative	Decrease in parametric value of 10 to 25%; not usually confirmable within 10 years.
-2	Moderate Negative	Decrease in parametric value of 25 to 50%; should be confirmable within 3 to 10 years.
-3	High Negative	Decrease in parametric value of 50% or more; should be confirmable within 3 years.

preliminary predicted impact ratings are being revised continually as additional inventory data become available, and as operational plans are changed, with the objective of producing a final set of expected impact ratings, on the assumption of expected mitigative procedures and imposition of some influence over secondary impacts.

Table 3 applies those impact ratings to a few major species of wildlife. The mule deer affords an example of modification of predicted impact ratings according to different reasonable assumptions about mitigative procedures. Initial ratings, assuming no special mitigation, and no planned control over secondary impacts, predicted moderate negative impacts locally and in Parachute Creek Canyon, and a light negative impact in Garfield County, during construction. During

TABLE 3. SELECTED EXAMPLES OF EXPECTED IMPACTS OF COLONY DEVELOPMENT OPERATION ON WILDLIFE, WITHOUT MITIGATION, AND WITH REASONABLE LEVEL OF MITIGATION.

SUB-COMPONENT	IMPACT CONDITIONS	KINDS OF IMPACTS		DIRECTION AND EXTENT OF EXPECTED IMPACTS								
				CONSTRUCTION			OPERATIONS			POST-OPERATIONS		
		PRIMARY	SECONDARY	LOCAL	INTERMEDIATE	EXTENDED	LOCAL	INTERMEDIATE	EXTENDED	LOCAL	INTERMEDIATE	EXTENDED
Mule Deer	Without mitigation	X	X	-2	-2	-1	-2	-2	-1	-1	-1	-1
	With mitigation			-1	-1	0	-1	-1	0	-1	0	0
Elk	Without mitigation	X	X	-3	0	-1	-3	0	-2	-2	0	-1
	With mitigation			-2	0	-1	-2	0	-1	-1	0	0
Mountain Lion	Without mitigation	X	X	-3	-2	-1	-3	-2	-1	-2	-2	-1
	With mitigation			-2	-2	-1	-2	-2	-1	-2	-2	-1
Golden Eagle	Without mitigation	X	X	-3	-1	0	-3	-2	0	-1	-2	0
	With mitigation			-1	0	0	-1	-1	0	-1	0	0
Chukar	Without mitigation	X	X	0	-1	0	0	-2	0	0	-2	0
	With mitigation			0	0	0	0	0	0	0	0	0
Commensal Birds	Without mitigation	X	X	+1	+1	0	+2	+2	0	+2	+2	0
	With mitigation			+2	+2	+1	+2	+2	+1	+2	+2	+1

operations, it was expected that moderate negative impacts would occur locally and in Parachute Creek Canyon, primarily because of uncontrolled offsite development within and surrounding the immediate area. In the long run, after operations ceased, light negative impacts were predicted.

The relatively high negative impact as described for the operational phase could only result if unbridled development were allowed to

proceed within Parachute Creek Valley, with the accompanying loss of a sizeable portion of the deer winter range. Such a situation is extremely unlikely, and development is being strongly encouraged outside the valley. In practice, of course, mitigation will have a demonstrable effect on the impact which is likely to occur. For example, control of hunting by workers during construction should help to reduce negative impacts at that time. Careful design of underpasses at important deer crossing sites in the canyon, construction of guzzlers to reduce the need of deer to cross the road, prudent use of deer-proof fences, and regulation of traffic, should reduce mortality of deer from collisions with automobiles, and reduce negative impacts throughout operations.

Further mitigation could be achieved by protecting winter ranges in the important tributary canyons of Parachute Creek, and by regulating access to summer ranges on the Roan Plateau, so as to restrict secondary impacts. Finally, modification of land use for optimum joint production of livestock and deer (McKean and Bartmann, 1971) could change the impact ratings from negative to positive. As mentioned, maintenance of the open space in Parachute Creek Valley is vital to the winter feeding grounds of the mule deer and development in this area is not contemplated.

With well-planned mitigation efforts, it should be entirely possible to reduce the negative impacts that would be expected from unplanned development to low levels. Indeed, strong attention to all of the above features accompanied by sound management might make it possible to increase the winter carrying capacity for deer and as has been noted earlier, to increase the hunter harvest.

In analagous fashion, it will be possible to reduce negative impacts for nearly all the wildlife sub-components by an order of magnitude. Colony has committed to this course by past actions, financial investment and establishment of an environmental staff. It feels such effort is appropriate in this environmental era of the 70's; such should be the goal of any new industrial venture.

DISCUSSION

The extensive environmental investigations carried out by Colony Development Operation since 1969, including the thirteen studies discussed in this paper, have produced information which has significantly affected operational planning. The common goal of these studies has been to maintain environmental quality to the maximum extent possible. Two characteristics of the Thorne study have been especially noteworthy; the degree of interdisciplinary coordination that has been achieved, and the frank and effective dialogue between

engineers and ecologists that has occurred. The ultimate objective of minimizing unnecessary adverse environmental impacts has yet to be tested. The planned monitoring studies and the various activities involving public participation that have been established are the necessary foundation for accomplishment of this ultimate goal. Publication of the Thorne study and other environmental studies should contribute strongly to other environmental impact analyses and will add to the store of public knowledge as well. A summary inventory volume (TEI 1973) is already available.

The Colony Development Operation is on private land. In all probability, Colony's commercial plant will be developed some time prior to any development on public lands. The U.S. Department of the Interior (1972, 1973) has recently published draft and has nearly completed final environmental impact statements for the proposed prototype oil shale leasing program on public lands in Colorado, Utah and Wyoming, but commercial production is probably some time away. The development of Colony's plant on private lands prior to any conceivable development on public lands is in keeping with public recommendations of some citizens' groups such as the Colorado Open Space Council (1971) which notes that oil shale development ". . . should succeed on private lands first before it should be permitted on the public lands."

CONCLUSIONS

The Thorne inventory and impact analysis has been a highly beneficial part of Colony's total environmental program. Its effect has been more pronounced because of the close cooperation of engineers and ecologists. The study has comprised a major input to Colony's total environmental program which should prove exemplary to future private industrial development of all types.

LITERATURE CITED

Alden, H. R.
1972. Systems for analyzing impacts of outdoors recreation programs on environmental quality. Proc. Western Resources Conf., Colorado State Univ. (In press).

Alden, H. R.
1973. Recreation resources. *In:* Thorne Ecological Institute. 1973. Environmental setting of the Parachute Creek Valley: an ecological inventory. Colony Development Operation, Denver, Colo. 6 p.

Colorado Division of Wildlife (Formerly, Colorado Division of Game, Fish and Parks). Various dates: 1966-71. Annual Reports. Colorado Big Game Harvest.

Colorado Open Space Council.
1971. Position statement regarding oil shale development. Denver, Colo. 4 p. Mimeo.

Cringan, A. T.
1973. Terrestrial vertebrate fauna. *In:* Thorne Ecological Institute. 1973. Environmental setting of the Parachute Creek Valley: an ecological inventory. Colony Development Operation, Denver, Colo. 10 p.

Ferchau, H.
1973. Plant ecology. *In:* Thorne Ecological Institute. 1973. Environmental setting of the Parachute Creek Valley: an ecological inventory. Colony Development Operation, Denver, Colo. 6 p.

Hutchins, J. S., W. W. Krech and M. W. Legatski.
1971. Environmental aspects of a commercial oil shale operation. *In:* AIME EQC 25: 59-68 New York, New York. (Reprints available from Colony Development Operation).
Kilburn, P. D.
1973. Environmental analyses by a new energy-producing industry. Paper presented at the 74th National Meeting of the American Institute of Chemical Engineers, March 11-15, 1973. 16 p. (Reprints available from Colony Development Operation.)
McKean, W. T. and R. M. Bartmann.
1971. Deer-livestock relations on a pinon-juniper range in northwestern Colorado. Colorado Division of Wildlife, Final Project Report, Project No. W-101-R-13. 132 p.
National Environmental Policy Act of 1969, 83 Stat. 852, 42 USC 4321 *et seq.* (1970).
Pettus, D.
1973. Cold-blooded vertebrates. *In:* Thorne Ecological Institute. 1973. Environmental setting of the Parachute Creek Valley: an ecological inventory. Colony Development Operation, Denver, Colo. 8 p.
Thorne Ecological Institute.
1973. Environmental setting of the Parachute Creek Valley: an ecological inventory. Colony Development Operation, Denver, Colo. 158 p.
U. S. Department of the Interior.
1972. Draft environmental impact statement for the proposed prototype oil shale leasing program. Washington, D.C. 3 vols.
U. S. Department of the Interior.
1973. Environmental impact statement for the proposed prototype oil shale leasing program. Washington, D.C. (In press).

DISCUSSION

ROBERTA WINN (Conservation Library, Denver, Colorado): As I understand it, your chart on mitigation and losses is on the basis of the one development itself. Had you, in this study, any way of assessing the impact as there is more and more development? In other words, is there some type of scale at which the losses to the wildlife outweigh the development itself?

MR. CRINGAN: Yes, Mrs. Winn. In this particular case the charge was to deal exclusively with the inventory of environmental resources related to the Colony proposal, and with the impact of the Colony proposal.

There is no way of anticipating whether there will be one more, ten more, or twenty more plants after this one is established. All we can do is attempt to predict the impact of this one development upon the environmental resources.

Now, in answer to your question, yes, studies are going on in connection with the prototype leasing program on public land; this will deal initially with the question of impact of the two proposed lease sites in Colorado.

* * *

BALANCING NEEDS OF FISHERIES AND ENERGY PRODUCTION[1]

J. A. MIHURSKY AND L. EUGENE CRONIN
University of Maryland, Natural Resources Institute, Chesapeake Biological Laboratory, Solomons, Maryland

INTRODUCTION

Considerable concern has developed in recent years as to how we are to meet our growing energy demands, both nationally and on a worldwide basis. Innumerable reports and publications have been released by a wide array of individuals, committees, agencies and both public and private interest groups. The crisis is real, not imagined. One problem is meeting society's energy demands (or needs) and the other deals with the need to make energy production, or energy conversion processes, compatible with environmental quality. On a long-term basis we must concern ourselves with the second law of thermodynamics and the excess temperatures resulting from energy conversion, be it heat rejection from biological activity, combustion processes, air conditioning, etc. Such heat emissions already are known to create heat islands around urban areas and influence local climatic conditions.

Expansion of this effect can cause regional climatic changes Landsburg 1970). For example, Jaske, Fletcher and Wise (1970) projected that in the year 2000 Bos-Wash megalopolis will have about 65 calories of heat rejected per square centimeter per day. This value is about 50 percent of the winter and 15 percent of the summer value of heat received by solar radiation on a flat surface. If we appreciate that the differential absorption and reflection of heat on the earth's surface causes movements of air masses, which in turn influences weather patterns, which in turn influences precipitation patterns, which in turn influences stream flow characteristics and vegetation patterns, which in turn influences food production for man, it quickly becomes obvious that we are in great need to get seriously on with the task of man's wise management of man and his use of energy and natural resources.

Based on 1960 estimates of a U.S. population of 300 million by 2000 A.D. the energy usage per capita is expected to increase by some 250 percent, and electrical energy is expected to increase by 1,350 percent in the same period (Figure 1). "The growth, shown in Figure 2, will occur primarily in the use of electricity to replace traditional heat sources in the conversion industries and for space heating"

[1]Contribution No. 549 of the Natural Resources Institute, University of Maryland.

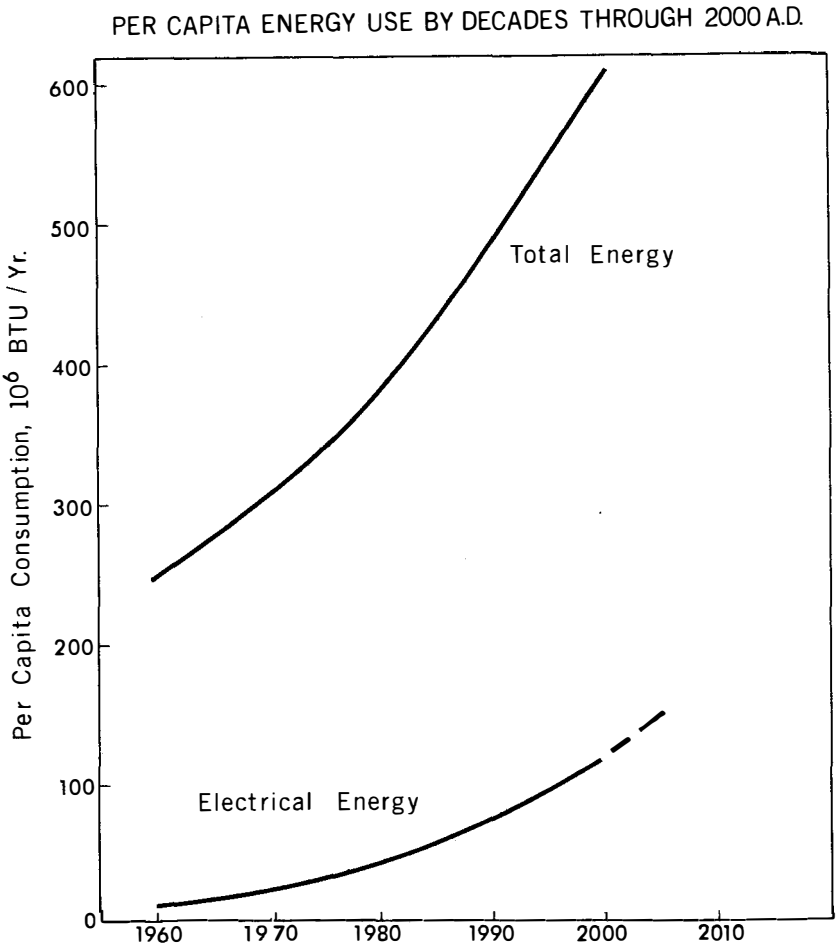


Figure 1.—Per capita energy use by decades through 2000 AD. (After Jaske 1970).

(Jaske 1970). Electrical energy use is projected to go from 24 percent of the national energy consumption total in 1970 to 34 percent in 1980, 42 percent by 1990 (Anon. 1970) and to 52 percent by 2000 (Jaske 1970). Lees (1971) stated that . . . "even assuming near zero population growth, a drop to one-half the present rate of growth in individual wealth, and a corresponding 50 percent reduction in the current rate of increase in power use in the next decade, U.S. consumption of electricity will *still* triple by 1990." Landsberg (1970) indicated that increases in per capita consumption have accounted for 90 percent of electric generation since 1940. Thus, if we

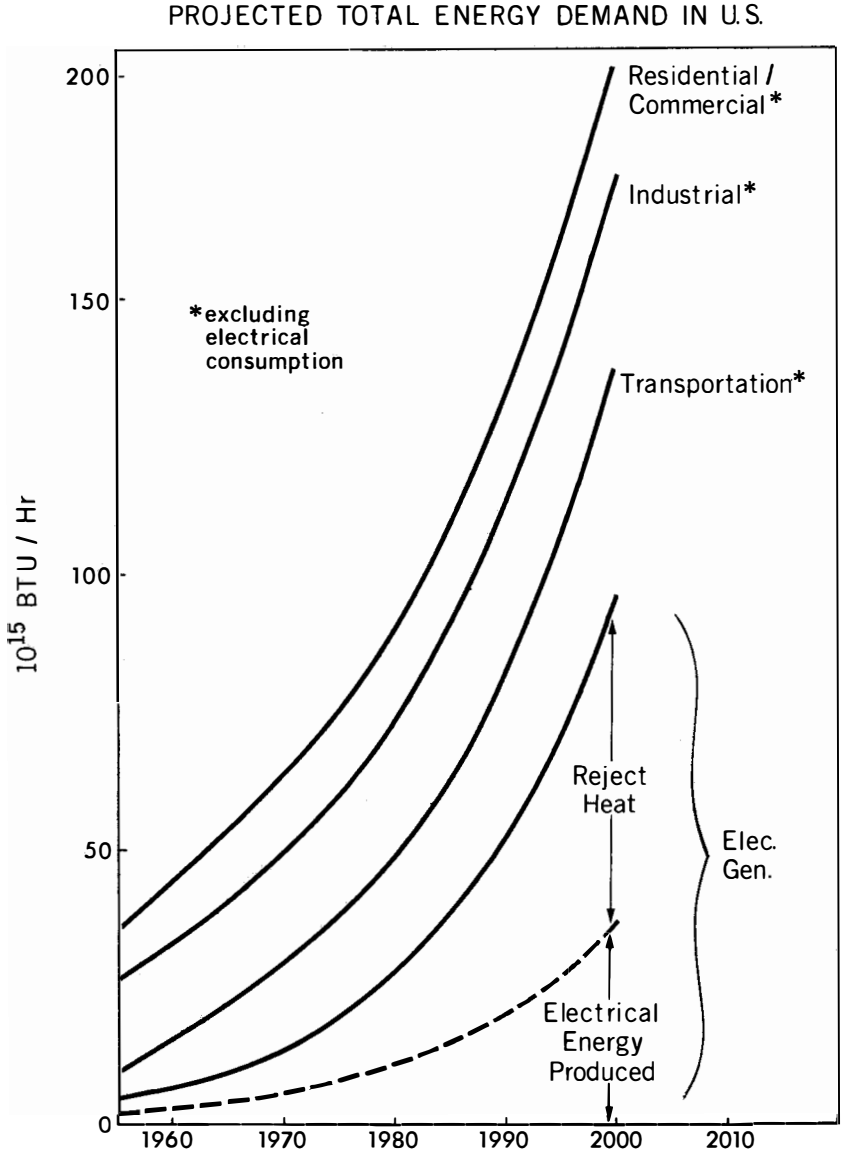


Figure 2.—Projected total energy demand in the United States (After Jaske 1970).

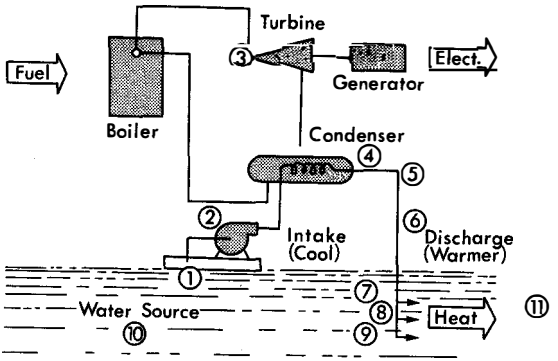
make the assumption that 1940 represents an acceptable base condition for electricity production and quality environment as well as for a desirable fisheries production condition, we must cut per capita electricity consumption by some 90 percent. Such a reduction undoubtedly would be unacceptable to society.

But why the concern for electricity production and fisheries production? Obviously, this concern is due to the present requirement to employ water in the engineering schemes needed to produce electric power, be it by hydroelectric or steam electric stations (S.E.S.). Hydroelectric dams can have serious damaging impacts on aquatic biological and fishery resources however, most dam sites in the U.S. have been developed and future expansion will be minimal. For that reason we will not enter into a discussion of hydroelectric dams and fishery production. For a recent summary of adverse environmental effects of hydroelectric installations and recommended methods for reducing these damages, we recommend reading the section on "Hydroelectric Considerations" (pg. 101-103) in the National Academy of Engineering publication entitled "Engineering for Resolution of the Energy-Environment Dilemma" (Committee on Power Plant Siting 1972).

ELECTRIC POWER PRODUCTION AND FISHERIES RESOURCE IMPACT

Although as stated earlier, long-term considerations portend climatological effects which may affect fisheries, our near term problems are predictated on the use of large volumes of water by S.E.S. to cool generators (Figure 3). For every 1 megawatt of electricity produced, 1.7 megawatts of heat are rejected by a S.E.S., corresponding roughly to 33 percent energy conversion efficiency for a typical fossil fuel plant (Engstrom, Bailey, Schrotke and Peterson 1972a). New fossil fuel units achieve about 40 percent efficiency while nuclear S.E.S. achieve about 32 percent efficiency. A typical water requirement for a 1000 MW S.E.S. is about 1500 cubic feet per second (cfs). Taking into account differences in plant and stack heat losses between fossil and nuclear S.E.S., fossil fuel units reject about 4.2×10^9 BTU/hr, while nuclear units reject about 6.6×10^9 BTU/hr. Thus average increases in temperature across condenser systems is 12°F for fossil and 20°F for nuclear units (Committee on Power Plant Siting 1972). Increasing size of single S.E.S. installations may require up to 50 square mile feet of water per day to be pumped for cooling purposes.

From the aquatic resource and fishery viewpoint, two major considerations are important when S.E.S. employ open, once-pass cooling systems: (1) pumped-entrainment and entrapment effects on planktonic and nektonic organisms and (2) discharge plume effects on near-field biota (Figure 4).



DESIGN PARAMETER	GENERAL PREFERENCE	ECOLOGICAL BASIS
1. Intake design	Behaviorally avoidable or provide safe return to environment	Poorly designed intakes trap fish, crabs, etc.
2. Volume of water pumped	Low (but site dependent)	Numbers of organisms affected
3. Turbine backpressure	Lowest feasible heat rates	Lowest backpressure permit low temperature discharges to environment (7) highest feasible efficiencies
*4. Temperature rise	Site and season dependent	Temperature-time relationships of effects
5. Length of cooling water piping in plant	Short (minimum transit time)	Temperature-time relationships of effects on entrained organisms
6. Length of transit to receiving waterway (canal or pipeline)	Short (minimum transit time)	Temperature-time relationships of effects, fish entrapment
7. Discharge location	Beyond littoral contact	Shoreline abundance of organisms (may be seasonal)
8. Discharge depth	Semistratified plume	Keep highest temperature water away from resident bottom organisms
9. Turbulence (exit velocity, port size or number)	High	Temperature-time relationships and areal extent of effects
10. Dilution (near field)	High	Plume entrainment, temperature-time relationship
11. Circulation (far field)	High	Temperature buildup for recirculation may change overall species composition

*Subject to mutual trade-offs at specific sites.

Figure 3.—Summary of cooling system design needs. (After Committed on Power Plant Siting, 1972)

Pumped-entrainment and Entrapment

Mihursky (1969) in reviewing results of studies completed at a S.E.S. site on the Patuxent Estuary, Maryland, emphasized that organisms could be killed upon passage through the condenser system and stated: Site selection for minimum damage becomes critical under such circumstances and the relative rates of destruction and recovery must be considered. If in-plant operations caused the S.E.S. to act as a predator and 'crop off' entrained stages at a rate

faster than organisms can regenerate in the open receiving system, then depletions in open estuary populations can be expected. Based on experience with Chesapeake Bay species, minimum regeneration times are approximately as follows for different groups of organisms:

Bacteria—minutes
Algae—hours
Copepods—5 days (summer)
Shrimp—6-12 months
Shellfish—2-3 years
Finfish—2-4 years

Coutant (1970) reviewed the available literature dealing with entrainment studies and reported destructive effects on a wide range of aquatic species at a variety of sites. Both Mihursky and Coutant have stressed the destructive effects of increased time exposure to increased temperatures. Long S.E.S. discharge canals increase exposure time of entrained organisms and increase the risk of damage.

Unfortunately, temperature alone is not the only possible limiting factor operating in the pumped-entrainment problem. The following aspects can be identified as possibly destructive:

1. Thermal
2. Biocide
3. Pressure
4. Turbulence—sheer fields
5. Mechanical

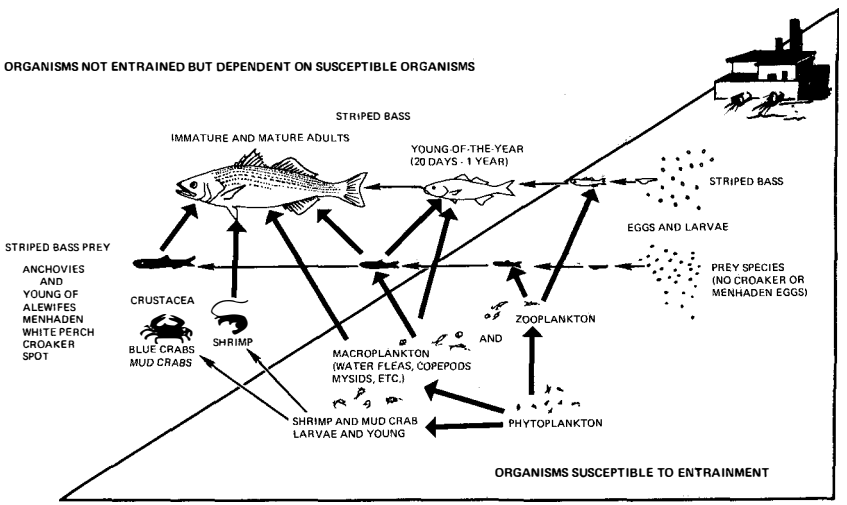


Figure 4.—Potential power plant effects on striped bass and associated food items. (After Bongers *et al.*, 1972)

Chlorine is the usual biocide employed to keep intake structures and condenser systems clear of fouling organisms and, by design, kills organisms. Pressure changes may occur due to (1) bubble collapse in the cooling system (2) pumping, and to (3) differential locations of intake and discharge levels. Turbulence may occur in the pumping system and in the immediate discharge area. Turbulence causes sheer fields which can rupture delicate organisms and early life-history stages. Mechanical damage can occur from impingement across intake screens in pumps, and from impingement across the one-inch diameter condenser tubes (Committee on Power Plant Siting 1972).

Recognition of the possible predatory or cropping nature of S.E.S., coupled with larger water requirements of larger S.E.S., dictates that we seriously strive to develop predictive "biostat" models for discrete ecosystems. Such modeling must incorporate:

1. Water use of S.E.S.
2. % effect of S.E.S. upon species.
3. Reproductive capacity of species.
4. Generation times of species.
5. Second order effects of any altered biological, predator-prey, host-parasite, host-disease changes in system.

Goodyear (1973) developed a predictive model for "Probable reduction in survival of young striped bass in the Hudson River as a consequence of the operation of Danskammer, Roseton, Indian Point Units 1 and 2, Lovett and Bowline steam electric generating stations (Table 1). A number of assumptions were made, including: (1) fish were considered to be entrainable for approximately 64 days, (2) mortality upon condenser passage was considered to be 100 percent (3) natural mortality was a function of age but not of density, (4)

TABLE 1. ESTIMATED REDUCTION IN STRIPED BASS YOUNG OF THE YEAR[1]

	Percentage Reduction According to Flow Year Simulated						
	1949	1955	1964	1967	1968	1969	1970
CONDITION							
No plants (base)	0	0	0	0	0	0	0
Danskammer	5.9	4.5	10.5	6.7	1.8	3.4	4.8
Lovett	12.4	16.0	9.5	9.7	4.5	15.6	15.1
Bowline	13.9	18.4	10.6	9.7	21.9	22.6	18.5
Roseton, Danskammer	15.1	12.2	23.7	16.9	5.3	9.4	12.8
IP 1 & 2	32.9	42.8	25.6	26.8	14.4	41.7	39.9
Roseton, Danskammer, Lovett, Bowline	37.1	40.9	40.4	33.3	29.2	41.5	40.5
Roseton, Danskammer IP 1 & 2, Lovett, Bowline	55.4	64.0	54.4	48.7	38.2	63.8	61.4

[1]Assuming flow conditions similar to the year specified. (After Goodyear, 1973)

the concentration of entrainable individuals in the intake water of each S.E.S. was considered to be the same as the mean concentration of the adjacent cross section. Table 1 reveals year to year differences due to variations in fresh water input flows. The results from 1968 reflect high fresh water flow conditions and consequent lower cropping rates by the S.E.S. due to lower percent water use compared to total river volume. The additive effects of the individual S.E.S. are also obvious from the table. The logical consequence of locating larger numbers of S.E.S. employing once-pass cooling water systems on spawning and nursery grounds of important fishery species is to risk considerable reduction or ultimate extirpation of the species to the ecosystem.

Discharge Plume Aspects

Discharge plumes may have various physical configuration depending on characteristics of the receiving water body and the design and location of the discharge structure itself (Committee on Power Plant Siting 1972). Biological effects of this plume are determined by the following factors:

1. Temperature elevation
2. Rate of temperature change
3. Chemical characteristics
4. Hydraulics

Mobile species may move into warmed areas, especially during cooler seasons, and be repelled during warmer seasons (Elser 1965; Merriman 1965; Mihursky 1969; Trembley 1965). Fish kills in discharge canals and plume areas have also been reported by a number of investigators (e.g. Alabaster and Downing 1966; Mihursky 1969; Trembley 1965).

Pertinent to the question of fish behavior in S.E.S. discharge plumes is a presently incomplete sonic tag behavioral study on striped bass being carried out by our laboratory, in the Patuxent Estuary in Maryland. Striped bass must pass by a 710 MW fossil fuel S.E.S. on their way to spawning grounds located in the 0 to 1 °/oo salinity zone approximately 7-10 miles upstream. No data exist on the behavioral response of these 15 to 65 lb. fish to the thermal plume which is located in the 5 to 7 °/oo zone of the estuary. Successful spawning of striped bass eggs is dependent on salinities of 0 to 1-2 °/oo. If the spring spawning-run fish move around the plume and to their spawning grounds then there is no problem; if the fish briefly move into the thermal plume area and still make it to their spawning grounds on time, again there is no problem; however, if fish remain in the heated water and gonad

maturation continues or is accelerated and egg deposition occurs, bass eggs is dependent on salinities of 0 to ½°/oo. If the spring spawn-there may be a problem. Of significance to this problem is the reported premature fish spawning and gonad development in thermal plumes reported by Trembley (1960) for the Delaware, Marcy (1969) for the Connecticut River, and Dryer and Benson (1957) for a TVA lake in Kentucky. Jones and Leggett (1968) have reported the results of sonic tag studies on shad in the Connecticut River in the vicinity of a S.E.S. Examination of their time-travel data indicates significant increased residence time in the river segment adjacent to the S.E.S. A delay in upstream migration of salmon due to a small amount of heated water seepage along a shallow shore line area has been observed in the Columbia River at the Hanford Reactor Site (Coutant, pers. comm.). Hence, the possibility of abnormal seasonal timing and abnormal physical location of spawning are important factors that must be evaluated in assessing S.E.S. impacts on a fishery resource.

Chemical emissions from S.E.S. are also of concern to fishery resource managers. Such concern is probably best supported by studies such as those reported by Roosenburg (1969). He found considerable increase in greening and copper uptake in oysters (*Crassostrea virginica*) after start-up of an S.E.S. operation. Greening and copper uptake increased with time and spread to 4.5 miles away from the plant site. Copper levels were reported to exceed those recommended as safe for human consumption. Metallurgical failure of S.E.S. condenser tubes (Leschber 1972) and consequent release of copper to the estuarine system was apparently the source of the problem. Roosenburg's study is also a reminder of the "magnifier-concentrator" nature of certain biological systems.

Although not well documented or understood, the effects of changed hydraulic conditions in the receiving water body, especially with larger water volumes pumped, may cause local effects on sediment scour and redeposition and thus affect bottom organisms. Changed hydraulic patterns also have the potential for altering the distribution of egg and larval stages and, for example, affect hatching success of fish eggs or affect setting characteristics of shellfish.

Certain authors have discussed possible alterations in predator-prey, host-parasite and host-disease relationships due to S.E.S. impact on aquatic resources and organisms (DeSylva 1969; Mihursky McErlan and Kennedy 1971). Such effects generally conceded to have the potential for causing "ecological death" to a species.

In summary, many local effects of S.E.S. have been described; however, a major and necessary task is to determine quantitatively whether normal species or community population dynamics or func-

tions are being impaired within the ecosystem. Such data are needed to be incorporated into ecosystem and regional input-output economic models to assist decision makers in establishing ecosystem strategies and objectives (Cumberland 1966).

To these ends, McErlean and his colleagues (McErlean, O'Connor, Mihursky and Gibson 1973) recently have evaluated over four years of an intensive and extensive finfish study in the Patuxent Estuary before and after operations of a 710 MW S.E.S. Various studies on this estuarine system and S.E.S. site have reported mortalities of post-larval fish upon passage through the cooling system and adult fish mortalities in the canal and plume area (Mihursky and McErlean 1971; Mihursky 1969). Examinations of fish species diversity indices for the estuarine segment studied revealed an annual cyclic pattern with a general trend for reduced diversity against time as typified by Figure 5. Although . . . "the study of ecosystems is presently in its earliest, primarily philosophical, phase of scientific inquiry" (Stevens, Bahr and Cole 1972), loss of biological diversity is treated with alarm by many biologists due to the apparent loss of energy flow stability within the system (Woodwell and Smith 1969). However, in

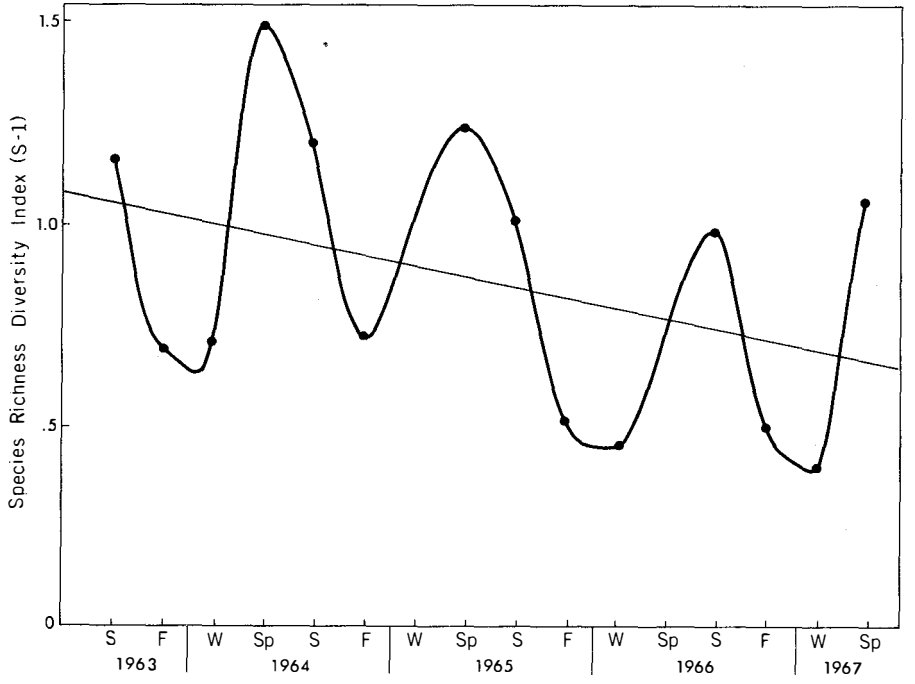


Figure 5.—Trend analysis for species richness diversity index (S-1). Note seasonal cycle and downward trend. (After McErlean *et al.*, 1973)

the above cited study by McErlean *et al.* (1973), it was stressed that it was difficult to assess the S.E.S. effect on the fishery from field data as other man-caused environmental changes were being imposed concurrently on the Patuxent estuarine ecosystem.

ENGINEERING ALTERNATIVES

Table 2 lists information on electrical power generating technologies and presents data and estimates for three categories: (1) Present systems such as hydroelectric, fossil and nuclear fueled S.E.S., and gas turbines, (2) developing systems for the short term (1970-2000) such as nuclear breeders, magneto-hydrodynamics and geothermal and (3) developing systems for the long term (after 2000) such as thermoelectricity, fusion and solar. Data important to aquatic systems are given in the columns entitled "Heat discharged to condenser cooling water" and "Expected % of total capacity by year 2000." In summary, the major energy conversion systems presently employed and available for the near term (to year 2000) dictate that vast quantities of waste heat will be discharged into our environment.

Recent studies evaluating waste heat assimilation capacities of various water bodies and regions of the U.S., as determined by limitations imposed by present state water quality standards, conclude that much of the existing water resources are insufficient to cool, on a once-through basis, the anticipated growth in the electrical generation industry (see for example, Engstrom *et al.* 1972a, b).

TABLE 2. ELECTRICAL POWER GENERATING TECHNOLOGIES

Method of Generation	Heat Disc. to Cond. Cooling Water BTU/KWH	Expected % of Total Capacity Year 2000
PRESENT SYSTEMS		
Hydroelectric (Conventional & pumped storage)	0	5
Fossil Fuel	3,900	10-20
Shale Oil, Coal Gassification & Coal Liquification (new fossil fuel)	3,900	10-15
Internal Comb. Eng.	0	<1
Gas Turbine	0	<1
Topping G.T. w/Waste Heat Boiler	0	<1
Light Water Reactors	6,600	30-40
DEVELOPING SYSTEMS FOR THE SHORT TERM (1970-2000)		
Gas Cooled Reactors	4,800	10-20
Nuclear Breeders	4,500	10-15
Fuel Cells	0	<5
EGD	0	<5
MHD	0	<5
MHD Topping Cycles	1,700	<5
Geothermal	0	<1
DEVELOPING SYSTEMS FOR THE LONG TERM (AFTER 2000)		
Thermoelectricity	0	0
Thermionic	0	0
Fusion	small	0
Solar	0	<1

After Anon. 1972.

It is becoming quite evident that the interfacing of power production and fisheries production must be managed more intensely than ever before, and quite differently than ever before (Mihursky, McErlean, Kennedy and Roosenburg 1970). What procedures must we follow and what alternatives do we have? The following brief list is abstracted from a more detailed treatment available from the National Academy of Sciences, Committee on Power Plant Siting (1972). That publication is strongly recommended for further reading.

- *National and regional energy policies must be established.* Obviously we must establish energy priorities and establish efficient energy use policies. We must also avoid overloading regional or local environments to the detriment of fishery resources having social value (Figure 6).
- *Site selection must be balanced with local or regional environmental vulnerabilities and flexibilities.* Sites or operational activities that would damage valued fishery resources must be avoided.
- *Engineering designs and operational procedures must be developed to reduce damage to aquatic resources.* Time-temperature designs must strive to meet experimentally determined tolerance capabilities of entrainable organisms. Biocides must be replaced by other mechanical cleaning methods, or nonfouling surfaces must be employed. Multiple intake options must be built into the cooling water design to permit intake water to be derived from horizontal or vertical locations in a water body where fewest entrainable organisms are located. These intake locations may vary daily as well as seasonally and should be dependent on known behavioral activity of pelagic organisms. Intake designs and screening devices must be developed to reduce entrapment of valuable species in intake bays.
- *Alternative cooling techniques must be explored and utilized as opposed to using public water resources.* Wet evaporative tower and dry-closed cooling systems must be employed where ecologically necessary in order to avoid damaging aquatic fishery resources. Industry-built cooling ponds and reservoirs are proper alternatives to natural public water resources.
- *Constructive use of waste heat and pumping activity should be employed where and when economically and ecologically feasible.* Enhancement of cool weather fishing by attracting mobile species to thermal plumes can be achieved. Extension of metabolic activity and growth can be obtained by biologically utilizing waste heat during usual dormant winter months. Selective favoring of certain species or mechanical elimination of undesirable species can redirect energy and material flow through aquatic food webs into useful fishery species and thus serve as a resource management tool.

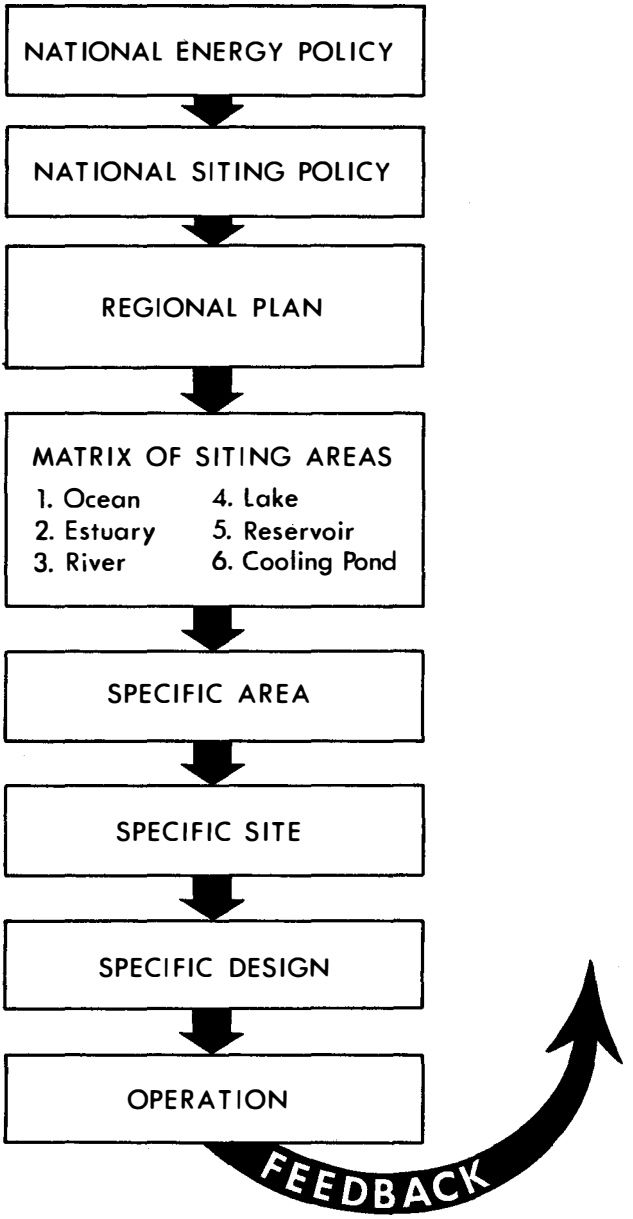


Figure 6.—Flow diagram: Power plant siting considerations. (After Committee on Power Plant Siting, 1972).

DISCUSSION AND CONCLUSION

It is clear that we are going to continue to witness energy production interfacing with aquatic resources, at least through the year 2000. Our challenge is to employ sound and innovative engineering practices with improved understanding of the existing local and regional environmental vulnerabilities and flexibilities of our fisheries resource. Many problems remain. Industry must modify their traditional economic and engineering approaches and strive to balance their needs with regional, social and environmental values. Hardware suppliers to the power industry must strive to design environmentally neutral components. Fishery biologists must learn to quantify their field evaluation studies in order to provide useful data to regional input-output economic models. They must also greatly improve their predictive modeling capabilities from properly designed field and laboratory studies in applied fishery biology.

To reach these industrial and biological goals, our academic institutions must do a far better job in providing the necessary academic avenues for proper training. We are indeed in a lag phase in this endeavor.

As aquatic resource managers we seem to have two major pathways open: (1) to manage in order to protect production of selected species, *i.e.* attempt to direct energy and material flow into species deemed socially desirable, so called target species or (2) to manage in order to protect diversity. Pathway (1) looks good on paper and appears to be the easiest to attempt and accepts the possibility of change in species composition and community structure. Pathway (2) tends to adhere to a philosophy that we should not knowingly kill organisms or eliminate species, a viewpoint that may be ecologically sound but most challenging and difficult to achieve in view of our limited skill in dealing effectively with problems requiring balancing of human action and biotic needs.

LITERATURE CITED

Alabaster, J. S. and A. L. Downing.
1966. A field and laboratory investigation of the effects of heated effluents on fish. Fishery Invest., London, Ser. I 6(4):1-42.

Anon.
1972. Water use and management aspects of steam electric power generation. NWC-EES-72-046. Report to the National Water Commission prepared by the consulting panel on waste heat. Nat. Tech. Info. Ser. Springfield, Va.

Bongers, L. H., W. F. Furth, A. J. Lippson and H. J. Obremski.
1972. An aquatic program strategy—power plant siting program. Research Institute for Advanced Studies. Martin Marietta Corp., Baltimore, Md.

Committee on Power Plant Siting.
1972. Working Group 1(b) Environmental Protection: Water. *In: Engineering for Resolution of the Energy-Environment Dilemma.* National Academy of Engineering, Wash., D.C., 1972.

Coutant, C. C.
1970. Biological aspects of thermal pollution. I. Entrainment and discharge canal effects. C.R.C. Critical Reviews in Environment Control. 1(3):341-381.

Cumberland, J. H.

1966. A regional interindustry model for analysis of development objectives. Regional Science Association Papers. 17:65-95.

DeSylva, D. P.
1969. Theoretical considerations of the effects of heated effluent on marine fishes. pp. 229-293. *In: Biological Aspects of Thermal Pollution.* P. A. Krenkel and F. A. Parker (Eds.) Vanderbilt Univ. Press.

Dryer, W. and N. G. Benson.
1957. Observations on the influence of the new Johnsonville steam plant on fish and plankton populations. Proc. 10th Ann. Conf. S. E. Assoc. Game and Fish Comm. pp. 85-97.

Elser, H. J.
1965. Effect of a warmed-water discharge on angling in the Potomac River, Maryland, 1961-1962. Prog. Fish. Cult. 27(2):79-86.

Engstrom, S. L., G. F. Bailey, P. M. Schrotke and D. E. Peterson.
1972a. Thermal effects of projected power growth: North Atlantic River basins. HEDL-TME 72-141. Hanford Engineering Development Laboratory, Richland, Wash.

Engstrom, S. L., G. F. Bailey, P. M. Schrotke and D. E. Peterson.
1972b. Thermal effects of projected power growth: South Atlantic and Gulf Coast River basins. HEDL-TME-72-131. Hanford Engineering Development Laboratory, Richland, Wash.

Goodyear, C. P.
1973. Probable reduction in survival of young of the year striped bass in the Hudson River as a consequence of the operation of Danskammer, Roseton, Indian Point Units 1 and 2, Lovett and Bowline steam electric generating stations. (Mimeo) U.S. Atomic Energy Commission. Hearings on Consolidated Edison Company's Indian Pt. nuclear generating unit No. 2, Docket No. 50-247.

Jaske, R. T.
1970. Thermal pollution and its treatment—the implications of unrestricted energy usage with suggestions for moderation of the impact. Mimeo paper for presentation and publication in session notes of *Environmental Management for Industry and Government* training course sponsored by the Industrial Management Center Inc., Austin, Texas, 1970-71 sessions.

Jaske, R. T., J. F. Fletcher and K. R. Wise.
1970. A national estimate of public and industrial heat rejection requirements by decades through the year 2000 A.D. Chem. Eng. Prog. 66(11). AICHE, Nov. 1970.

Jones, R. A. and W. C. Leggett.
1968. A study of the rate and pattern of shad migration in the Connecticut River utilizing sonic tracking apparatus. Progress Rept. to Connecticut Yankee Atomic Power Co. (Mimeo) 1968.

Landsberg, H. E.
1970. Man-made climatic changes. Sci. 170:1265-1274.

Lees, L. and others.
1971. People, power, pollution. environmental and public interest aspects of electric power plant siting. EQL Rept. #1. Calif. Inst. of Tech., Environ. Qual Laboratory, Pasadena.

Leschber, E. W.
1972. Premature failure of type 316 stainless steel condenser tubing in brackish water. (Mimeo) Presented at the American Society for Metals (ASM) Show and Materials Engineering Congress. Clev., Ohio., Oct. 17-19, 1972.

Marcy, B. C.
1969. The Connecticut River Investigations. 9th Prog. Rept. D. E. Merriman (Ed.). Rept. to Conn. Water Res. Comm. 13 Oct. 1969.

McErlean, A. J., S. G. O'Connor, J. A. Mihursky and C. I. Gibson.
1973. Abundance diversity and seasonal patterns of estuarine fish populations. Estuarine and Coastal Marine Sci. 1:19-36.

Merriman, D. and Staff.
1965-1972. Semiannual progres reports to Connecticut Yankee Atomic Power Company, Haddam, Conn.

Mihursky, J. A.
1969. Ptauxent Thermal Studies—Summary and Recommendations. Univ. of Md. Natural Resources Institute. Spec. Publ #1.

Mihursky, J. A. and A. J. McErlean.
1971. Post-operative assessment of estuarine power plants. Third report to the Maryland Department of Natural Resources. Univ. of Md. Natural Resources Institute. NRI Ref. No. 71-24b.

Mihursky, J. A., A. J. McErlean, and V. S. Kennedy.
1970. Thermal pollution, aquaculture and pathobiology in aquatic systems. Wildlife Diseases. 6:347-355.

Mihursky, J. A., A. J. McErlean, V. S. Kennedy and W. H. Roosenburg.
1970. Regional planning and the Chesapeake Bay environment: An ecological approach. New England Coastal Zone Management Conference—Proceedings pp. 47-74. The New England Center for Continuing Education, Durham, N. H. April 28-29, 1970.

Roosenburg, W. H.
1969. Greening and copper accumulation in the American oyster, *Crassostrea virginica*, in the vicinity of a steam electric generating station. Chesapeake Sci. 10(344): 241-252.
Stevens, H. K., T. G. Bahr and R. A. Cole.
1972. Recycling and ecosystem response. NWC-EES-72-042. National Water Commission. Nat. Tech. Info. Ser., Springfield, Va.
Trembley, F. J.
1960. Research project on effects of condenser discharge water on aquatic life. Prog. Rept. 1956-59. Institute of Research, Lehigh Univ., Bethlehem, Pa.
Trembley, F. J.
1965. Effects of cooling water from steam electric power plants on stream biota. *In*: Biological problems in water pollution. 3rd Seminar, Aug. 1962. PHS Publ. No. 999-WP-25 pp. 334-345.
Woodwell, G. M. and H. H. Smith, Eds.
1969. Diversity and stability in ecological systems. Brookhaven National Laboratories. Nat. Tech. Info. Ser. Springfield, Va.

DISCUSSION

FROM THE FLOOR: I think you asked more questions than you can answer. This seems to me to be a biological problem of such proportion that I don't think a human being can come up with an answer. But, it has been noted, that salmon have come back in certain places so maybe the fish are trying to outthink us.

If you'd like to make any comment on that, I'd like to hear.

DR. MIHURSKY: It seems the organisms are learning to adapt to man; and, of course, over geologic time organisms have undergone genetic and evolutionary changes.

But the point is, if we take the attitude that the organisms are going to adapt to whatever we do, we lose out because man is causing changes so fast that we don't have time, the geologic time, if you will, for the organisms to adjust. Yes, they can adjust, but not as rapidly as we are requiring them to at present.

DR. CRONIN: I'd like to make two comments in reference to the question; one is, needed knowledge and urgency are so great, it does sometimes seem impossible. It doesn't seem that we could possibly get there fast enough through a rational approach.

However, there are two responses that we can make to that, as a whole community. Where we have exceptionally rich resources we can adapt public policy. We can say we will not permit potentially destructive uses beyond levels which we know enter that destruction. We can adapt a firm public policy that stops use a little short of probable serious damage, and fight for that on the basis of the best knowledge we have. That is being done in some places, although it is a continuous matter.

Secondly, we can hurry up our learning. We may not be fast enough, but we can be far faster than we have been. In Maryland, the State has adopted a program which has real potential, the Power Plant Siting Act which places a tax at the generating point on all commercial production of electricity—1/10 mil per kilowatt of electricity; this goes into an environmental trust fund administered by the State's Department of Natural Resources, and can be used for research, supporting the work we are doing. It can be used for studies at specific sites; it can be used for monitoring the effect of plants, and it can be used for acquiring, if the State decides to, sites which seem to have potential for use for power plant location.

This is a continuing development, two years old, and they are finding it not easy to protect this fund because it is up to four or five million dollars a year, a substantial income. And yet, it is producing already a rapid, a tremendous search and attention to the problem, and in many kinds of learning, physical, biological, and social-legal, so progress can be made more rapidly than it has been.

DR. HARRIETTE PHELPS (Federal City College): It seems that the second alternative, maintaining a species, should become a part of the policy as a result of the need to set aside areas for maintaining diversity, and others for the purpose of culturing other species. But species must be deliberately maintained in

areas, and we don't know the size, or extent of these areas, but that has to be worked out. That is part of our whole policy for land and water use.

DR. MIHURSKY: Yes, I personally prefer the diversity approach. In various states around the United States, the approach seems to be one of aiming at a target species, to protect those that are commercially valuable, recreationally valuable, or perhaps of esthetic value.

The assumption being made is that to protect the target species you protect the rest of the necessary organism. So far as I know, this has not been demonstrated. So, if we maintain that approach of protecting target species, we are running a risk.

CHAIRMAN PIMLOTT: In the previous paper we had an example, at least of a pilot operation, and I think that very intensive pilot operations are particularly important in society in helping us to get over some of the problems that confront us because it seems that it takes an imaginitive, innovative effort to simulate our acitivity.

Is there a really good pilot operation anywhere in North America that really is starting ecological considerations at first engineering stages, and then is going to follow right through?

DR. CRONIN: Dr. Mihursky touched on that. The reason there isn't, in my opinion is because the rules of the game have been to permit private interests to decide what is desirable for the good of the public, and what they decided has been, for a long time, given tremendous encouragement. They have been given many special privileges, and they have developed their own criteria to design construction. Only within the last ten years has that even been seriously questioned.

I have heard of no case where we have gone far enough back into the process, to use environmental criteria, or even exercise present engineering potentials. Again, that would be a fine exercise in a classroom or model-operating system, or on any other scale.

MR. HERBST: Northern States Power Company in Minnesota is going through this kind of process. They put together a comprehensive taskforce and set up criteria for the selection of a power plant site, and put it as a challenge before the Governor's Policy Council. We have gone through an extensive review in selecting the site for them. So, there is at least one company that's making a try in this direction.

DR. MIHURSKY: I appreciate that what you are describing is a paper approach. The question that was asked was, are we setting up a pilot operation where we have an array of possible pumping procedures that are used in the industry, that are available as a testing operation?

Do we have an array of discharge canal designs, of condenser designs, of alternate cleaning devices available to the operation; in other words, a miniature power plant that has a tremendous amount of versatility built into it as options to operate the plant; and then go on and test method one versus method two and method three, to alter the temperature differentials, the pressure aspect, and the chemical aspect?

That is the type of pilot plant that the gentleman had in mind, and those of us in the game have discussed this after meetings. This kind of operation as far as I know, has not been undertaken by anyone.

DON STRODE (Reston, Virginia): I have heard a lot of talks since I have been here, that seem to resolve around the idea that we can develop a technology which will not use up resources. No one, as far as I know, has talked about what appeared to be a fact of life.

The consumer in the United States had better learn now that they have to control, and have the use of their technology controlled to stop using up the resources.

The figure on electrical consumption illustrates the approach; they project usages on the basis of increase today, and think of no controls to be made on that. It seems to me self-evident that controls will have to be put on, and the consumer may as well face the facts of life.

I am curious of the speaker's reaction to that, inasmuch as he has been in the details of that for some time.

DR. MIHURSKY: In my estimation, and the estimation of a number of other people, we are going to have to put controls on ourselves; we are going to have to take the position of population control, and we should take the position that resources should not be shunted down a one-way pipe, but should be recycled. What that means is that we are going to have to get seriously into the job of managing ourselves. We have to modify life styles.

We are not going to have this random walk type operation that we have been witnessing, that is very vulnerable to special interest groups where the fast buck is the objective and other qualities that we individually value are going to be ignored and not put on the table in terms of cost:benefit analysis.

For a further, and good discussion of recycling, I recommend a publication by Stephen Warren Cole entitled, ***Recycling and Ecosystem Response.*** It was developed for the National Water Commission and is available from the National Technical Information Service in Springfield, Virginia. It's a publication that should be read seriously and taken under advisement at the national policy level.

DR. PIMLOTT: Well, there you have, ladies and gentlemen the series of papers that dealt with some of the interfaces. I hope you found it a satisfying experience, and I want to express our appreciation to the people that gave papers this morning, and I appreciate particularly the way they respected the time constraints that we placed on them.

It was an easy acting role as chairman. I do want to express my appreciation to Bob Herbst for acting as discussion leader.

* * *

PART III
CLOSING GENERAL SESSION

GENERAL SESSION

Wednesday Afternoon—March 21

Chairman: ROBERT E. DILS
Dean, College of Forestry, Colorado State University, Fort Collins

Vice Chairman: JAMES A. CRUTCHFIELD
Professor, Department of Economics, University of Washington, Seattle

PRIORITIES IN RESOURCE MANAGEMENT

REMARKS OF THE CHAIRMAN

JAMES A. CRUTCHFIELD

Ladies and gentlemen, I would like to get our session called to order.

I would also like to apologize for having to appear as your chairman. The Chairman was to have been Robert E. Dils, College of Forestry at Colorado State University. Unfortunately, Bob ran afoul of a recurrence of the London flu and is hospitalized and so sends his regrets. I shall do my best to fill in for him.

INTRODUCTORY REMARKS

NATHANIEL P. REED

Mr. Chairman, ladies and gentlemen, it is always an honor to participate in the Wildlife World Series. I am pinch-hitting today for my pitcher under a new set of guidelines. Secretary of the Interior Morton could not possibly have attended this great conference, and he asked me to convey his best wishes to you and deliver this personal message from his desk and I quote:

My sincere greetings to the North American Wildlife and Natural Resources Conference. As my meeting with you this spring was impossible to arrange, I regret not having had an opportunity to express to you my sincere gratitude for your support, counsel and understanding over the past two years. As you know, I have constantly walked a tightrope in my efforts to balance America's demands for natural resources with the environmental imperative. You have traditionally supported me in this endeavor. Please be assured that I am with you today in spirit if not in body. I know your Conference will be a great success.

Best wishes.

ROGERS C. B. MORTON

Let me add that the Secretary is in excellent shape, active as ever. I spoke with him just the other day, and I was extremely encouraged by his strength and buoyant spirits.

BALANCING DEMANDS FOR NATURAL RESOURCES

NATHANIEL P. REED
Assistant Secretary of the Interior for Fish and Wildlife and Parks, Washington, D. C.

Now, to get back to the question of *balance,* the message from the Secretary of the Interior. As Secretary he is called upon to perform miracles. Walking a tightrope is putting his plight mildly. *Miracles* is a better description because Interior has 21 bureaus, offices, and agencies with 21 different missions and objectives. These 21 functions are constantly conflicting and produce a mind-boggling decision-making process, unsurpassed in its tendency to complexity, contradiction, and confrontation. Each bureau, each mission has an effective lobby and a slew of champions on the Hill and in the field.

But let me, as we bureaucrats often do, put off "the dilemma" for a few minutes so I can digress to the concerns which are really close to my heart. Regrettably as a politician, I was not born in a log cabin on the frontier. Even more regrettably as an administrator of natural resources, I have no Ph.D in ecology, or wildlife management, or any other environmental pursuit. I cannot fool you experts. I am an amateur. But if I have the qualifications of an amateur, I have the concern of an aficionado. My long suit is that I care enormously about my country's future and I believe you are our key trump cards. You men and women are surely among the most critical of forces as we seek to motivate and encourage and cajole and coerce our institutions toward environmental sanity.

I work long hours and I have taken some hard knocks, but my associates and my comrades-in-arms, including yourselves, make it all seem worthwhile. My own two years' tenure has been an extraordinary experience, and it has left some extraordinary marks. I have met most of the people in this hall and have savored the richest of relationships with many of you. We have not always agreed—we may never agree on some issues—but we have always freely interacted and communicated, and we have remained issue-oriented and deeply motivated.

Our motivation is sometimes questioned. And I must say I am sick of those who, rather than agreeing to disagree, would not only question the motivation of an environmentalist but imply that he is disloyal to his country.

Who among us has never made a mistake?

I see many bright faces but I see few halos. The era of the vendetta is over. The back-stabbing must come to an end. It will take a united comraderie joined by everyone in this room to insure a future for our children and for the bountiful resources of this continent.

The game management executives in this room have been incredibly successful, but we're only halfway home. There are countless examples in our history where, using intensive and wise game management practices, our herds and flocks have rebounded from disastrous lows to healthier-than-ever highs. The key to this has been preservation of habitat, without which the opportunity to rebuild wildlife populations does not exist. But, you know that . . . I am with my peers.

So let's get back to unity. The protection of a vital duck production area in North Dakota is just as vital in Louisiana as it is in North Dakota. The grasslands of California are no more critical to wildfowl management in that state than to wildfowl management in British Columbia and Mexico. The preservation of the major wildfowl nesting areas in Alaska has a direct bearing on every outdoorsman and game manager in North America and many across the Pacific.

Like it or not, we share the same vast ecosystem as we share the land mass of the continent. We have not finished our work and we don't even approach that great day until we approach it together. Implementation of new programs is hard enough without the enormous setback of a divided constituency.

I say hard enough because I've sensed a curious paradox. In this era of genuine environmental concern, in most sectors programs and initiatives move so desperately slowly. *But,* remembering "the old days" when many of you were truly "voices" crying in the wilderness," I begin to realize just how very far we have come.

But then, technology has come even farther. It has caught up with us and passed on ahead.

In the "old days" we never dreamed of coal shovels ten stories tall—never foresaw that the shame of Appalachia would become the threat of Montana.

Who would have believed that our estuaries would become the focal point for a new breed of real estate impresarios, hucksters, and promoters who come armed with a permit for dredge and fill for wholesale destruction of the breeding grounds for fish on which my children's children may well depend?

Who would have believed that the seemingly boundless supply of natural resources on this continent could seemingly be, at last, in such short supply?

I believe, for example, that we do face a real short-term energy dilemma. I believe we can solve the energy dilemma but panic must not be part of the decision-making process.

We cannot afford to thwart legitimate national priorities. I've always questioned the "growth is God" theory, *but* I stand firmly for development of our basic resources. It is *how* we develop those resources which concerns me.

We have never been a careful or prudent people. That is not our stock. We are descended from men and women who were descended from adventurers. They found a wilderness so fruitful they could overlook tragic mistakes.

Well . . . we can't overlook those mistakes and we can ill afford them. We can't afford oil spills caused by carelessness or negligence. We can't afford industries or cities which use rivers as dumping grounds.

We can no longer afford to acquiesce to the single-minded dictates of the engineering profession.

We can't afford land and timber practices which for short-term gain destroy basic ecosystems.

We can't afford pork barrel water resource developments which were designed as make-work projects.

Any further trading we do on this continent must be done with care, weighing national alternatives with each step we take, balancing short-term gains against potentially long-term losses.

So, back to balance. How does a Secretary of the Interior keep the balance between the legitimate needs of people and the often unprovable needs of wild animals? He walks the tightrope, but the tightrope is a fuse, and it has been lit at both ends. Many of you in this room have seen much of the key habitat of Africa disappear in 25 years; that of India in 20. Our Canadian cousins have seen their Atlantic

salmon fisheries nearly decimated by greed and their pothole country drained to add more grain for offshore sales.

In North America, we are playing with a weak hand until we bring our population growth under control.

If we continue to be the world's most gargantuan consumer of raw materials in never-ending pursuit of a seemingly higher standard of living without moderating our demands, then I believe the cracks will begin to appear.

We must have a steady hand and take an unemotional, caustic look at those who guarantee "progress" Progress is a curious word when it means a Teton or Tellico Dam.

And we must be fiscally mature. Name me a society with *any* concern for wildlife or environmental quality if her people are starving. Inflation and a fiscally irresponsible government can bring our civilization to its knees. I share President Nixon's concern that our priorities be fiscally sound and that we reach a *spending balance* as well as an evironmental balance.

Balance is the byword and I hope that I've made clear that I'm leaning hard on my side of the scales. But if it were not for you and your legions, frankly, I might be discouraged. But knowing I have your support, I will continue to lean.

We each have only one turn at this game, once around. We have no time for family squabbles, wasted effort, wasted time, wasted energy.

That's the challenge, that's our mission. We are few, but we believe. In spite of the late hour, there is a tremendous opportunity. That's our challenge!

Are we ready and willing to give our all?

reed

DISCUSSION

MR. MICHAEL NADEL (Wilderness Society): Mr. Secretary, there have been some recent measures which would give broad authority to the Secretary with respect to granting right-of-ways to transportation corridors. So far I know there is nothing in any of these measures that would insist or provide that the Secretary assess the possibilities for putting all transportation needs or proposals, rather for gas, oil, highways, etc., into a single corridor. What is your view about that?

MR. REED: There is nothing in the basic legislation that requires the Secretary to put all basic transportation within the single corridor and I don't think you can possibly design a bill that would say that he must. He would certainly, under the National Environmental Policy Act, have to study with care what his alternatives were and assure that the public's interests would be well protected under the 102 process. However, I would have problems dictating to him that there would be a single route across an ecosystem that was best for all transportation systems.

If you were going to build a road anyway, then I presume your question comes down to why you would not put a gas or oil pipeline with it. The 102 provision would indicate I should or would.

* * *

EXAMINING BUDGET PRIORITIES: NATURAL RESOURCES

WILLIAM A. MORRILL
Assistant Director, Office of Management and Budget, Washington, D.C.

Pressures on the federal budget run in one direction. Few programs, small or large, lack supporters who strongly believe more money should be spent on them. Our thinking and our newspapers focus on particular programs which do not seem adequate or problems as still unsolved.

Somehow the total gets lost—perhaps because it is a mind-boggling $268.7 billion in outlays as recommended by the President for the fiscal year beginning next July. Indeed, without some very tough actions and recommendations by the President, it would have been larger. Business as usual—but without any new initiatives—would have produced a budget totalling $288 billion; and new initiatives could have added more to the swollen total. These 1974 numbers compare with a 1972 budget totalling about $232 billion and a 1970 budget of about $196 billion. In summary, the federal budget has been increasing at a rate of about $18 billion per year, and it could be much more.

These facts raise questions about how decisions are made, what the total level of the budget should be, and how decisions are made on priorities and funding levels of numerous and varied programs. The budget process provides an annual opportunity to reconcile conflicting views as to what the Federal Government should do and what its role should be.

In formulating the federal budget, we are concerned with fiscal policy—the total budget and its impact on the nation's economy—and with individual programs—their purpose, scope, and effectiveness.

The President has adopted the full-employment budget concept. This means that total government expenditures should not exceed the level at which the budget would be balanced under conditions of full employment. The full-employment budget principle permits stimulation when stimulation is appropriate. It permitted and called for substantial actual budget deficits for fiscal years 1971 through 1973. This principle also calls for restraint when that is appropriate. With the economy on the upswing, a shift away from fiscal stimulus and toward restraint and a smaller actual deficit is called for for FY 1974.

The 1974 budget proposes an approximate balance in full-employment terms and an actual deficit of $12.7 billion, which is about one-half of the 1973 deficit.

It is within the ceiling set by the full-employment budget concept

that we look at individual programs. What factors do we consider in our examination of programs?

The first consideration is, "What are the program's objectives and goals? Does it meet today's national needs?" A responsible government must change its activities to meet the changing needs of its citizens. The budget's emphasis on environmental programs while holding the line in defense and space illustrates the adjustments that are made.

Assuming a need for a program is it a proper responsibility of the Federal Government? Or is it more appropriately a responsibility of state and local governments? Or can the need be met by the private sector of the economy? If the benefits of a program are localized or enure to a particular group in the society, there is good reason to question whether such a program should be a federal one.

If the program is appropriately a federal responsibility, what alternative ways are available for meeting the objectives and goals? Is one alternative more effective and efficient than the others? Should the objectives be met through governmental direct funding versus regulation? Should, for example, the program be operated by a federal agency or by state and local governments with grant assistance from the Federal Government? An example is whether pollution control should be achieved by regulations, technical assistance, or subsidies.

Another question is, "Is the program effective and is it meeting its purpose?" And, of course, we are always interested in efficiency—we need to be frugal in spending money.

Our analyses and evaluations attempt to quantify as much as possible, or at least be specific and explicit. For example, in the school lunch program, we are interested in the number of pupils to be served and at what cost. Or in the management of national forests, the number of recreationists to be benefited and the volume of timber to be sold. Where possible, we do benefit/cost studies. In our analyses we try to foresee all impacts of a program—adverse as well as beneficial. We are not ashamed to admit that we do not uniformly succeed in providing an analytic base for decision-making that meets our own standards of excellence—some of the problems are really difficult. At the same time, we are equally unafraid to keep asserting that such an analytic base is needed and possible.

From analyses, we try to formulate alternative budget levels for various programs. Then it's a matter of cutting and fitting the various pieces within the total. Presidential judgment and priorities are a central part of the cutting and fitting process.

This process is complicated by what are uncontrollable items; for

example, interest on the public debt, and payments required by law for such programs as old age and survivorship benefits, and medicare. These open-ended programs and fixed costs total over $150 billion in 1974, or about 57 percent. Other outlays from prior-year contracts and obligations are relatively uncontrollable. Relatively controllable outlays total $75 million, or about 28 percent of the total budget.

At this point before going on to describe the federal budget for natural resources and environmental programs, I would like to briefly cover the President's Departmental Reorganization Program. Among other benefits, the reorganization will provide an improved organizational mechanism for determining program priorities and trade-offs among activities.

The President proposed a sweeping reorganization of the executive branch to enable the Federal Government to more effectively carry out its responsibilities according to the major purposes of government. He proposed four new departments—one of them being a Department of Natural Resources. This new department would have transferred to it the programs and functions of the Department of the Interior, the Forest Service and Soil Conservation Service of the Department of Agriculture, the National Oceanic and Atmospheric Administration of the Department of Commerce, and certain functions and activities of the Army Corps of Engineers, the Atomic Energy Commission, and components of other agencies.

The creation of this new department will bring together and provide leadership and direction for all of those federal activities which most directly relate to the discovery, assessment, development, and utilization of natural resources. It will provide a means of achieving a balance between preservation and development.

With the establishment of the new department, it will be possible to:

(1) Establish a center of responsibility for developing unified natural resources policies for consideration by the President, the Congress, and the people, and the implementation of such policies.

(2) Provide for necessary accountability to the public through discrete assignments of responsibilities.

(3) Provide greater effectiveness in the development of policies, plans, and evaluation of performance than is now possible with responsibilities and programs scattered among several agencies and with the small staff provided by the President.

(4) Provide a broader organization but one dealing with a common purpose to permit more adequate consideration of priorities and tradeoffs among competing programs.

While hearings have been held on the President's Departmental Reorganization Plan, none of the new departments has yet been authorized by the Congress. To provide the necessary direction and coordination mechanism in the interim short of the reorganization, the President has appointed counsellors to cover the areas of human resources, community development, and natural resources. But the objective and effort to achieve departmental reorganization remain unchanged.

Returning to the budget, the President had this to say about natural resources and the environment in his budget message:

> The balanced development of our natural resources is essential to a healthy economy and an improved standard of living. Development inevitably brings change to our natural environment which, if not properly controlled, could impair the health and welfare of our citizens and the beauty of our surroundings. Balancing the need for development and growth with the need to preserve and enhance our environment has become a major challenge of our time.
>
> Meeting this challenge is not solely the responsibility of the Federal Government. Heavy responsibilities fall on State and local governments, private industry, and the general public as well. This budget reflects my determination to seek a proper balance between development and preservation. It contemplates neither blind or insensitive exploitation of our natural resources nor acceptance of a no-growth philosophy. It avoids such a spurious choice and plots an orderly and reasoned course toward sensible development and environmental enhancement.

Gross outlays for natural resources and environmental programs will total $6.9 billion in 1974, an increase of $690 million over 1973 and $1,770 million over 1972. The 1974 level is nearly double the 1969 level.

Highest priority is accorded to pollution control and abatement programs which deal with air, water, pesticide control, toxic waste management, and other problems of environmental quality. Outlays for these programs will increase nearly $1 billion in 1974 to a level of $2.1 billion, and will continue to increase in the next few years on the basis of commitments which have already been made to deal with criticial environmental problems. For example, appropriations and allotments available in 1973 for grants to states and municipalities for construction of waste treatment facilities total $10.1 billion, compared to $214 million as recently as 1969.

Another area which is given increased emphasis in the 1974 budget is that of research and development to help meet the nation's need for clean energy. Total outlays for energy R&D programs will rise by

over $100 million to $752 million in 1974. The Atomic Energy Commission will intensify work on its top priority civilian program—the development of an economical, liquid-metal fast-breeder power reactor. Outlays to improve techniques for producing energy from coal without causing pollution will increase to $60 million in 1974. This effort is directed to research in coal liquefaction, coal gasification, and magnetohydrodynamic generation of electric power, an approach which, if successful, would reduce fuel requirements per unit of electricity generated and reduce the adverse environmental effects of generation. In addition, a central fund for energy research and development will be established in the Department of the Interior to provide a flexible source of support for the exploration of promising nonnuclear technologies.

Two programs that may be of particular interest to you are the Land and Water Conservation Fund and the Migratory Bird Conservation Account. While we are sympathetic to acquisition of areas for outdoor recreation and for the conservation and production of migratory waterfowl, we had to make some hard decisions because of competing demands for budget dollars.

Thus, the 1974 budget includes an appropriation request for $7 million as compared to $14 million in 1973 for the migratory bird program. In terms of program levels—that is, what is expected to be accomplished—the amounts are $9 million in 1974, compared to $12 million in 1973. What this means is some deferral of land acquisition. The reduction comes from not making an advance of appropriations from the Treasury to the fund. No reduction is anticipated in the amount going to the fund from duck stamps purchased by hunters and others.

You may have heard that cuts in the Land and Water Conservation Fund were drastic. In terms of appropriations, the budget goes from $330 million in 1973 to $85 million in 1974. However, because of unused funds that are being carried over, the effective program level in 1974 will be $258 million as compared to $307 million in 1973—a substantial reduction but not a drastic one. Here, too, there will be some slowdown through deferrals of land acquisition, but the importance of the program is recognized and its objectives will be met. For example, an estimated 174,000 acres in 1973 and 172,000 acres in 1974 will be purchased for federal park, historic, recreation, and wildlife areas. We are particularly anxious to maintain as much momentum as possible in the state grant program.

In connection with the purchase of park, historic, recreation, and wildlife areas, and the preservation of wildernesses, the question arises of how much is enough. We are hopeful that the national

outdoor recreation plan being prepared by the Department of the Interior will provide insight into that question. We also clearly need to develop a better understanding of the responsibilities to be carried by each level of government in meeting preservation and recreation needs. The Federal Government cannot do it alone, and we need to define who is to do what. In addition to the studies in process at the federal level, I would be hopeful that the land use-control legislation being sponsored by the Administration—if enacted—would lead to a thorough-going dialogue at state and local levels resulting in firm state plans to protect sensitive environmental areas from undesirable exploitation.

In conclusion, I have attempted a general description of how budgets are considered and what has emerged from the most recent one. As a process, the budget is an ongoing effort to improve the way choices are made within a set of sensible economic guidelines. We can make it a better process and plan to do so, but the choices are forced upon us whether we are ready or not. As a product, the most recent budget was hard going all the way. It is full of very difficult choices, but ones that had to be made if we intended—as the President clearly did intend—to avoid higher taxes, renewed inflation or both.

FEDERAL ORGANIZATION TO MEET RESOURCE NEEDS

ANDREW M. ROUSE

Vice President, INA Corporation; Past Executive Director, President's Advisory Council on Executive Organization, Philadelphia, Pennsylvania

There was a time—a considerable time—in the earlier days of this country, when nature was considered to be man's worst enemy.

Trees were something to be cut down so that crops could be planted. Animals were there to be killed for food and clothing or to protect crops. It was difficult or impossible to keep warm in the winter or cool in the summer. Life was apt to be bleak, survival uncertain, and it isn't likely that anyone alive then could have imagined the situation we're in *vis-á-vis* our environment today.

Today nature is no longer the enemy, but a friend we think we may have mistreated a little along the way. We have begun to make adjustments in our relationship with many of the things we had taken for granted.

The air we breathed. The streams and rivers and lakes we fished in and drank from. The earth we mined and drilled and tilled. The forests and birds and animals that we had really never considered except as accessories to our own existence. Nature was boundless and inexhaustible, and nice to be out in on a spring day.

Today we have acquired—uneasily—a new relationship with nature, with a new lexicon indicative of our doubts. We hear words, loud and insistent, that bear on our new dilemma: energy crisis, pollution, North Slope, California condor, off-shore drilling, strip mining, clean water, inner city, urban sprawl, and so forth. The belching factory smokestack which was, and is, a sign of progress and prosperity, has also become a symbol of pollution.

We're the first generation of Americans to face the problem of balancing the use and preservation of our resources and environment. We seem to have arrived simultaneously at the Age of Aquarius and the Age of Ecology, and most of us have mixed feelings as to what our proper stance should be.

There are those who would have us make a direct choice between use and preservation, and there are still extreme points of view on both sides. But it seems more realistic to think that we are going to have both, as we always have.

Common sense tells us that we aren't going to permit America to become one big industrial slag heap. And common sense also tells us that we can't preserve America as a mammoth nature museum either.

The problem about which you have heard so much is what kind of balance we are going to strike. The fact that we have arrived at an environmental crisis and an energy crisis at the same time only makes the problem more pressing.

The public demand for ever-increasing quantities of goods and services puts more and more pollution pressure on the environment, and a greater drain on our energy resources. Secretary Butz, in his role as counselor to the President, has said that "in our kind of society resources are meant to be used intelligently, efficiently and productively."

If we can agree on the concept of achieving an optimum balance of use and preservation we have at least made a start. But it's a long way from agreement on a concept to the action necessary to carry out that concept.

The concept must be translated into a policy, the policy into a program, and finally an organization must be built or borrowed to implement the program. I'd like to talk to you briefly today about some of the considerations involved in doing this.

* * *

Each step in this progression requires its own conceptual framework—and these basics of policy and program must be resolved before we can effectively or usefully deal with the concepts of organization.

If they are not, the organization will not be properly structured to

achieve its goals efficiently. Pockets of duplication will appear, and they will spread. Goals will obscure and be left to interpretation by the machinery of the organization. Action will be slowed or stopped. Efforts will be dissipated.

Part of our problem today stems from that source. While we are generally agreed on the need for balance between use and preservation, we haven't yet resolved the conceptual issues of policy and program. But we have on-going organizations "doing their thing"—with the results I have just mentioned.

It is probably unrealistic to hope that we can resolve these matters of policy and program on a long-term basis. But if we can do so for at least the period of one presidential administration, then it becomes relevant for us to examine the concepts of organization.

The key concept of organization, it seems to me, is that we are most effective when we construct our organizations around the goals we want to achieve. An obvious concomitant to this is that when the goal or purpose of an organization changes, then the organization must change too.

In this light no organization should expect to be immutable. No organization should be unchanging in the face of changing goals. And when we attempt to resolve the balance between use and preservation of natural resources, we must examine in this way those organizations which are to be the vehicles for taking us where we want to go.

The Department of Interior, for instance, was created more than a century ago as a general housekeeper for the Federal Government. Over the years various functions have been added and removed. The Department has grown tremendously in size and in the scope of its responsibilities.

But it has also become the advocate of its own programs, and parts of it are often perceived to be inflexible in their commitment to one interest or another, contending here for preservation and there for use. These circumstances tend to put more political pressure than planning into the decision-making process.

It has been a tenet of our government organization that decisions on policy and program be arrived at through the adversary process of decision-making. Congress, of course, is set up to perform in this way. So-called pressure groups and advocates of particular courses of action function basically in this way.

Many of our past Presidents have felt more at home with this style of decision-making. And it is at least partially responsible for the current fragmentation of related programs in more than one government agency.

I think a case can be made that we've reached a point of crisis where the traditional adversary process is a luxury we really can't afford if we're going to do a satisfactory job of balancing use and preservation of our natural resources. We're going to have to change our organization for handling this situation, just as we are already changing our policies and our programs.

Timely action is essential. Decisions that will affect our environment for years ahead are being made today, and they are being made for us in the haphazard rush of events.

Exclusive of air and water, we now use the mind-boggling quantity of 25 tons per person of basic materials each year, and this usage is growing at the rate of almost a ton a year. If present trends continue, energy use will double in 10 years; water in 18; and metals in 22 years.

In the remaining years of this century the United States will use more energy and more key resources than it has consumed since the founding of our nation.

Decision-making on matters involving the use and preservation of our natural resources need not be made through the adversary system. Decisions can also be based on planning—and this process is already a common tool of American business.

* * *

This kind of planning is not an easy process. It requires the professional disciplines of weighing alternatives, thinking ahead, and quantifying wherever possible.

Decision-making through planning also requires the ability to control and direct implementation. Otherwise the process is sterile at best, useless and wasteful at worst. To exercise this control over the nation's natural resources, any organization that is charged with maintaining a balance between use and preservation must contain *all* of those agencies and programs which relate to natural resources (including, in my view, the energy resources of the nation).

If we deny this proposition we are either insisting that adversary decision-making is the only viable decision process applicable to government, or we are placing in the hands of the President alone all decision-making in this sphere.

The latter is the case if no one below the President is in a position to resolve the issues of use versus preservation. And these issues are at the heart of most decisions in the natural resources area today.

This is clearly an unreasonable burden. The President cannot do everything. It is a fair question today to ask if the American Presidency is not already an almost undoable job.

Furthermore, to place this burden on the President makes political strength the common denominator for decisions having future impact well beyond the tenure of any political view or administration.

On the other hand, if we opt for a planning mode in decision-making we are placing in a cabinet position the control of all programs and organizations impacting on the broad field of natural resources.

The arguments against placing control in a single agency fall into three general categories:

First, there is the argument that this type of structure undermines the power of interest groups to influence policy and programs.

I don't think this is the case. What it does is to position the point of action below the President's office and require better informed debate. There is always Congress, which will preserve the adversary mode. And, as a last resort there is the President's office which, it is safe to say, will remain responsive to well-reasoned and balanced argument on any cabinet secretary's position.

Then there is the argument that policy must of necessity reflect value judgments—and that the planning mode seems to attempt to substitute numbers for these value judgments.

But planned decision-making does, of course, include such judgments. The difference is the level of expertise, thoughtfulness and rationality which form the framework in which values are applied. And it seems logical to believe that balance is better advocated by broadly-oriented professionals than by small groups of the politically (and socially) elect.

National goals are subject to innumerable solutions—and dividing their implementation among several departments almost guarantees failure in achieving them.

There is also the argument that some issues are so important in themselves that they demand a separate agency to advocate them. But this only puts us back in the woods from which we're trying to emerge.

If we create a separate department for every narrowly defined national problem, we make the President's job even more impossible, and we make the achievement of national goals again a subject of barter and unending political pressure.

It seems to me that if we are going to have a single organization to control the balance between use and preservation of our resources, it should be along the lines proposed in the President's legislation to establish a Department of Natural Resources. In this proposal lies at least the possibility of creating a forum able to resolve the conflicting

demands that must be met with a maximum of professionalism and a minimum of rhetoric and fragmentation of effort.

It provides a possibility only. I am not sanguine that it can be more than that. In the end we seem able to mobilize the nation to action only when confronted by a crisis of great magnitude. But the crises that concern many of you here are not of that sort—they happen gradually.

On the other hand, the offsetting crisis—an inadequate supply of energy, for example—may seem suddenly overwhelming. In what context, we must ask, is the sum of concern for the myriad of little dangers best balanced with the legitimate worry about the adequacy of our fuel supply?

As tenuous and problem-filled as it is—I would argue that in one great agency of government, with its professionalism and its institutional memory, lies the best hope of achieving a satisfactory accommodation between legitimate interests, some urging us to use and others to preserve our natural resource heritage.

* * *

DISCUSSION

MR. SMALLEY: In 1950, a distinguished Canadian told me that there were three hierarchies at that time that stood between world understanding. One was Communism, the other was the Roman Catholic Church and the third, in connection with your speech, was the Constitution of the United States.

Communism was split up and the Roman Catholic Church has fallen apart and the Constitution is still intact and I think that it where the trouble lies. We have one party in power at present, another in Congress, and they spend all of their time playing politics. They say it is going to end up in the courts and I don't know which way the courts are going to decide. Maybe you should comment on that.

MR. ROUSE: I don't know which way the courts are going to decide either but you raise a very important question.

Part of the answer lies in the need to professionalize the Congress. I don't think we have to change the Constitution to do that. Congress has to realistically start doing some work and by "work" I do not mean passing laws necessarily. I mean doing the professional task or seeing that the professional task is done. Of course, that doesn't mean that politics will still not be a serious problem when the Congress is of one party and the President of the other, but I would argue that political judgment will be significantly better than we have today.

DR. ROBERT GILES: I have major misgivings about these statements but perhaps I can phrase them as questions.

The first is that quality, without quantifiable goals and objectives, is a very hollow shell. I see no such goals and objectives within our federal environmental agencies at the moment and to expect us to emerge full bloom in a very short time is beyond my grandest expectations.

My second comment would be that among the ecologists, this group, we can demonstrate that diversity and redundancy is a very powerful ecosystem principle, producing stability in considerable extent.

One of the problems of going through a monoculture agency is that while there is a possibility of doing good things, there is also the very grave and high probability of great fluctuation in the system from peaks of excellence to total despair, which might be better evidenced in this group years from now.

My third comment is that an agency such as that being proposed at the moment, does have the useful feedback function. That which is proposed and currently comprised by the Office of Management is continually not functioning very well and what we in fact need is a very wise ombudsman to overlook, oversee such an agency. Also, I have not seen anybody in the audience with a halo as yet. We have certainly undergone, during this speech, a crisis which disturbs me. The alternatives that you give us are simply an advocacy of an adversary form of government or a presidential form of government, which is quite too simplistic. Existing agencies that we have, with designed competition among them, would give us a natural resource structure far more vigorous, vital and responsible to the needs of our nation than that which you currently propose.

MR. ROUSE: Of course, I agree that it is too much to hope that we will have quantified goals in the natural resource area soon or perhaps ever. The question one must then ask, it seems to me, is whether, because you will not have such statements or are not likely to have such statements, you therefore are immobilized from making some very important statements about what your vision of the future is. I think it is sufficient to do that, at least for the time being and, further, in doing that, you in fact do enough, in my view, to shape the kind of programs that you might need to carry out these goals.

The value of diversity and redundancy is a point which is often made against the kind of monolithic structures that I have recommended. I do not believe that we can demonstrate with any conviction that diversity and redundancy in government organization and operation have brought us very far. We can demonstrate reasonably convincingly to the contrary, that diversity and redundancy sound good—they certainly give ample room for a lot of disagreement and for a lot of position taking—but they do not get us very far. We don't make progress against a great many of the issues that plague us and natural resources is one of them.

I agree that a useful feedback function is lacking. I don't think the OMB does that task effectively. I don't think anybody does. I don't think that the GAO, for example, which has that as one of its functions, at least with respect to Congress, provides it effectively, and we need it.

The idea of an ombudsman has been tossed around. I don't mean to use that sort of term but it has been discussed and studied and it has, it seems to me, considerable merit. There have been several problems, the most recent one being by Tugwell, which asks that we establish a fourth branch of government to be made up of senior officials and, something like the French, that will provide a surveillance function, an Inspector General function, for all of the operations of government. That idea, of course, is simply an academic number at this point and would obviously require constitutional amendment to effect.

Also, I agree, that the Presidential government or the adversary process is simplistic. There is a good deal, however, more behind the description of the adversary process and how it works in our government for the managerial system imposed upon the department. Now, for those of you interested in this detail, there are public documents which describe its concept, how it is supposed to work.

In general, I am not unsympathetic personally to the problems you have raised and the conclusions of my remarks are that I am not sanguine about the value of creating such a department, or—let me put it this way—I am sanguine that creating such a department will work. I am not pessimistic, I am not optimistic that there is very much that will.

DR. GILES: Again, may I make one comment?

Progress, or however we get it is relative to goals. Feedback is operative only with goals and in relation to whether we get any place at all. At least I am optimistic that with our present structure redeveloped, reorganized, reimproved, revitalized, we have a very strong probability of success with our ongoing but improved structures.

* * *

EQUIPPING STATE GOVERNMENT TO MEET RESOURCE NEEDS

W. MASON LAWRENCE
Deputy Commissioner, New York State Department of Environmental Conservation, Albany, New York

The states have a long history of concern and action relating to management of natural resources and environmental protection within their borders. While recognizing the important responsibilities of the Federal Government and other local governments in these fields, the states have felt that they are the logical level of government to provide the leadership role in resource management. The extent of state responsibility varies, of course, in those states where a major part of the land area is owned and managed by the Federal Government.

Initial state efforts usually involved the creation of an agency and a program to serve a single resource; *i.e.* a fish commission, a forestry commission, a game commission or a water commission. Over the years these agencies have been broadened, enlarged, added to and subject to many organizational changes. The trend has been to consolidate under a single agency and leadership responsibilities for two or more related resources, resulting in the creation of fish and game agencies, fish, game and forestry agencies and conservation or natural resource agencies responsible for most of the recognized natural resource areas. There have been notable exceptions to this trend, however, and a number of instances of consolidation of agencies followed by a subsequent splitting off of responsibilities for particular resources or certain aspects of resource management.

The institutional arrangement for administering resource agencies has generally been one of two types. One, a department under the direction of a cabinet officer, who is appointed by and reports to the governor. Two, a public board or commission which has the responsibility for policy setting and whose members are appointed by the governor, usually for staggered terms to assure overlapping any one gubernatorial term of office.

The sudden awakening during the late nineteen-sixties of the general public and its elected officials to the impact that man's activities had had and was continuing to have on our natural resources brought an insistent demand for corrective action. As a result, most states have taken a hard look at their conservation and environmental agencies to determine how well equipped they are to respond to the public's continuing concern that natural resources and

the environment are major items on the agenda of unfinished public business.

A number of states have already made substantial changes in the organization of their natural resources and environmental agencies to improve their capability to solve environmental and natural resource problems. Other states are evaluating their organizations to determine the need for changes.

At present, states might be divided into three general groups on the basis of the organization of their resource and environmental agencies:

1. States which have made no basic changes in their traditional organization other than to add new units to handle new responsibilities or to add new responsibilities to existing units. As noted previously, many of these states are evaluating the need for change.

2. States which have brought together from various departments, agencies, commissions and board the functions and responsibilities related to environmental protections in one agency and the functions and responsibilities related to natural resources in one or more separate agencies. Arkansas, Idaho, Illinois, Maine, Minnesota, Mississippi, North Carolina, Ohio, Oregon, South Carolina, Virginia, and Washington are examples of states with this type of organization.

3. States which have brought together all or most all of the functions and responsibilities relating to environmental protection and natural resources in a single agency. Connecticut, Delaware, Michigan, New Jersey, New York, Pennyslvania, Vermont and Wisconsin have this type of organization.

Two factors have played a role in bringing about these changes. The paramount consideration in some states has been to draw together the major strands in environmental protection and resource management in a single agency with comprehensive outlook and authority. In other states, the changes have occurred as part of an overall program to increase the efficiency and effectiveness of state government.

There are reasons why some states have opted for a single agency and others for separate environmental protection and natural resource agencies. Those states which have established separate agencies believe that each agency will have stronger programs as a consequence of not being encumbered with the mission of the other and that the public interest will be better served by an advocacy system in which one agency argues for pollution control while the other agency advocates the state's interest in resources. The states which have elected to establish a single agency believe that the major elements in environmental protection and resource management are so intertwined and mutually supportive that separation of the agencies

responsible for these areas lleads to duplication, unnecessary conflicts and in general less effective programs in both areas.

There are also differences among the states, without regard to whether they have one or more agencies, in the internal structuring of their agencies. The Washington Department of Ecology has a functional system of internal organization. Most states' agencies' basic organization is program oriented with some functional structure in some states in areas such as enforcement, research and planning.

In the reorganizations that have taken place, the major objectives sought included all or nearly all of the following:

1. Provide a stronger regulatory role for the state in environmental protection activities.
2. Consolidate fragmented activities to make them more responsive to current environmental problems.
3. Eliminate a number of boards and commissions to make state government more manageable.
4. Transfer of pollution control programs from health department to broaden pollution concerns beyond health.
5. Establish an organization which is concerned with mangement of all phases of the environment.
6. Increase the efficiency of state government in the management of the environment.
7. Establish a clearer public image of the agency as the one dealing with overall environmental problems, thereby enlisting the power of public opinion in pollution abatement and environmental protection.
8. Eliminate the conflicts, duplications and overlaps that occurred when the responsibilities for resources and the environment rested in many agencies.

Let me illustrate briefly how these objectives are being implemented in one state, New York, and make a few observations on the results to date. Legislation in 1970 created a new Department of Environmental Conservation, bringing together in this one agency; the natural resource functions from the former Conservation Department; the air and water pollution control, the solid waste management and the radiological control responsibilities from the Health Department; the existing pesticide control functions from the Department of Agriculture and Markets and the functions of several interagency boards. The legislation also gave the new Department duties and authority which none of its predecessors had had. Most notable of these were the mandate to develop a statewide environmental plan, which is nearing completion, the authority for the Department to review other state agencies' programs which may affect the

environment, and emergency power to the Commissioner to order an immediate halt to practices he determines might result in "imminent danger to the health or welfare of the people of the state . . . or irreversible or irreparable damage to natural resources" . . . without public hearing. When this power is exercised, hearings must follow within 15 days.

In the two-and-one half years since the creation of the Department, we have implemented a field structure of nine strong consolidated regions with responsibility for all Department programs administered in the field. Our observations are that this new organization has resulted in:

—Improved coordination among programs.
—Increased recognition of the opportunity for programs to be mutually supportive.
—Greater efficiency through administrative decentralization and pooling support services.
—Simplified channels of co..munication, and
—A much clearer image of the Department as the agency handling overall environmental problems.

Prior to establishment of the new Department, New York had an enforcement system geared to earlier concepts of voluntary compliance and compromise with serious delays in prosecuting cases. Through reorganization and system changes, we believe we have reversed these inherited trends and shown the citizens of the state that we will take firm and positive enforcement action to fulfill the state's commitment to environmental protection. To accomplish this we have:

—Established an attorney in each of the nine regions to handle cases completely in the field working as a team with the engineers and conservation officers.
—Streamlined procedures and applied firm but fair enforcement procedures to reduce the number of time-consuming hearings. These steps have cut down time and red tape and we find they work.
—Initiated a new system of performance bonds to ensure compliance with orders and imposed penalties on polluters which reflect the damage to the environment.

One measure of the effectiveness of these procedures is that air, water and solid waste polluters in New York were penalized more than $1 million in 1971. The 184 orders issued levied fines of $473,000 and required the posting of $633,000 in "good faith" financial guarantees with the Department. Based on our experience and data these figures will have been exceeded in 1972.

We have also retrained our conservation officers so they can assist the regional attorneys and regional engineers in enforcing pollution laws in addition to their traditional enforcement of the fish and wildlife laws. In turn, the regional attorneys have bolstered the conservation officers in their traditional responsibility for enforcing the conservation law.

We have established in the central office and in each region a unit whose major concern is environmental impact review. The main thrust of these new units is to coordinate review by program experts, first at the field level and then in the central office, to assure that all program interests are considered and that interdisciplinary conflicts are resolved. This device has enabled the Department to focus on total environmental concerns which transcend the more narrow program interests.

We are now working on methods to provide technical assistance and guidance to state agencies and private developers so they are aware of the way in which their actions affect the environment. In the long run this appears to be the best way to encourage industrial, commercial, residential and community development actions which preserve environmental quality and promote sound development of our natural resources.

When our new Department was established, we inherited a local assistance program to county health departments for local administration of water, solid waste and air pollution control programs. In reviewing these arrangements, we found there was considerable overlap and duplication of effort between the state and the localities. One approach we considered was a complete state takeover. However, as we explored the problem further we recognized tha these county health departments were on the front line of environmental protection. Therefore, our effort has been to integrate and coordinate the work of these local units into a total environmental effort. This has not been simple but we have a system now in which we define activities in cooperation with local health departments to reduce overlap and duplication.

In implementing our reorganization, emphasis has been given to maintaining our traditionally strong resource management functions. As we plan for the future, we have continued as one of our highest priorities to faithfully and diligently execute the traditional resource programs.

In addition to the actions already described, we have during our short existence as a new Department undertaken new regulatory programs in protection of endangered species, pesticide control, noise

control, scavenger waste registration, power plant siting, vehicle emissions and hazardous substance control.

Similar steps to those cited have been taken by a number of states. There are in addition other important new approaches in resource management and environmental protection that have been instituted by several states. Among these is recent legislation giving the states authority in land use planning and controls. Hawaii has the authority to establish zoning criteria and to define major zones throughout the state within which local governments have specific controls. Maine and Vermont have established state permit systems to control large commercial, industrial and housing developments. Minnesota, Vermont and Wisconsin set zoning criteria for shorelines and flood plains and have the authority to take over zoning in these areas if local governments fail to act. Washington taxes undeveloped land on its present use and not its development potential.

Connecticut, New Jersey and Maryland require a state permit for development of wetlands. Massachusetts has authority to control the use of wetlands. New York, Maryland, Vermont and Washington require either a permit or site approval for construction of a thermal power plant.

Recent legislation in New York is designed to protect high quality agricultural lands from development for other uses. Participating landowners benefit from a mandate that policies of state and local governments must encourage maintenance of viable farming within the districts and shall not unduly restrict agricultural practices. A limitation is placed on the power of certain service districts to impose assessments and levies. The exercise of public domain by state and local government is curtailed through a process of public accountability. The landowners are also helped by the provision of tax relief based on an agricultural assessment ceiling. Under this program, 24 agricultural districts have been established, which provide protection to about a quarter-million acres of agricultural land. Applications now being processed will bring this total to over one-half million acres.

To assist local governments with water pollution and solid waste management programs and to encourage regional approaches to the solution of these problems, Maryland, New York and Ohio have created agencies which have the authority to construct and operate solid and liquid waste treatment and disposal facilities for local governments. Maryland's agency also has the authority to take over a violator's waste treatment and disposal facilities until compliance is achieved.

Michigan law provides for class action lawsuits by private citizens to prevent environmental damage. Similar legislation is under consideration now in a number of state legislatures.

The examples cited above are not inclusive of either all the approaches that are obeing taken or of all the states which are taking similar action. They do illustrate, however, the number and variety of actions now being pursued by the states to enable them to respond more effectively to the imposing problems of resource management and environmental protection.

A discussion of equipping government to meet resource needs, even as cursory a one as this, should include mention of major problems which are receiving inadequate attention. I would rate land use as high among such problems.

We are making progress in air and water pollution control. However, we are just beginning to approach the third basic element in our environment, land. In many areas the lack of control of land use is leading to an awful mess. There are many difficulties involved in correcting the present situation including: the traditional right of a man to use his land as he wants, the taking of rights without due process of the law and the question of state versus local control of land use. However, we must get on with the job of planning for and implementing the plans for more rational use of our land.

Another major problem which is receiving insufficient attention is agricultural run-off. In rough terms, up to one-third of water pollution in some areas comes from animal husbandry operations and run-off of fertilizer. As we clean up the pollution from municipal and industrial sources, the pollution impact from agricultural run-off is going to be much more apparent. The land run-off problem is difficult to control. There is currently no proven technology to apply to it. Furthermore, it is institutionally difficult because there are numerous small units involved. Again, however, we must develop the methods and technology to control this source of pollution in order to complete the job of water quality.

Technological obsolescence of the equipment and systems employed in pollution control is another problem that haunts us. Despite important developments in the treatment of sewage such as physical and chemical treatment, the basic oxygen process, more efficient sedimentation and the application of automation and computers in plant operation, the basic construction and operation of sewage plants have not changed materially in the past 65 years. The methods of handling solid wastes are not much changed from those of Roman times. To insure that the billions of dollars are being spent on pollution control devices and structure are not wasted, a greater

investment in research and development to provide the best available technology seems clearly indicated.

In summary, the states and their citizens recognize natural resources and the environment as major public issues. This is important because there are few public issues which really capture the public attention sufficiently to bring about action and change.

Many states have made substantial changes in their organizations and enacted far-reaching legislation to equip them better to meet resource and environmental need. Other states are actively considering similar changes.

The changes have been in operation for such a short time, less than thre years in most instances, that it is not possible to evaluate the results objectively or to determine which of the various approaches being used are most effective. Observations indicate, however, that the changes represent improvement and that substantial progress is being made.

Two points require special mention. One, several important problems, such as land use, agricultural run-off and technological obsolescence, are receiving insufficient attention by any level of government at present. Two, the problems of natural resources and the environment are dynamic and ever changing. There is little likelihood that organizations, programs and technologies of 1973 will be adequate to meet the needs in these areas in the 1980's. These characteristics are not peculiar to resources and the environment but apply also to most of the areas of responsibility of state governments.

In recognition of this situation Governor Rockefeller has appointed Russell Peterson, former Governor of Delaware, to make a detailed study of "The Modern State in a Changing World." I would hope that this and similar studies would produce new information and new ideas that would equip the state better to meet the resource and environmental needs of the future.

COASTAL ZONE MANAGEMENT: A PROGRESS REPORT

ROBERT M. WHITE
Administrator, National Oceanic and Atmospheric Administration, Department of Commerce, Washington, D. C.

INTRODUCTION

It is a pleasure to be invited here today to speak to you on the important topic of coastal zone management.

I do not intend, in the brief time allotted to me, to recite the litany of coastal zone problems. Many articles and scholarly papers on the nature of the problem and the need for improved management of coastal resources have appeared in recent years. Nowadays, the daily newspaper often contains an article or two on the latest coastal zone conflict. And I would expect that this audience above most others is all too familiar with the present highly stressed situation in many of our coastal areas.

Rather, what I intend to do is to discuss the philosophy behind the new Coastal Zone Management Act of 1972, some of its principal provisions, and how NOAA is going about planning for its implementation. This seems appropriate to me because I share the feeling of many others that the passage of the Coastal Zone Management Act was clearly the most important development on the national level dealing with coastal resources of the last decade. The Act, if properly administered and with the cooperation of the states, has the potential for bringing about a much improved management scheme for this nation's coastal zones.

APPROACH

Congressional deliberations leading up to the passage of the Act (92-583) were well supported by a number of carefully executed coastal studies. These included the National Estuary Study, the National Estuarine Pollution Study and the report of the Commission on Marine Science, Engineering, and Resources, the so-called Stratton Commission. The latter, available in January of 1969, focused especially on the need for both national and state programs to better manage our limited but critically valuable coastal zones.

The Commission report recognized that not only was the coastal zone management problem difficult technically, due to a relatively poor understanding of the coastal ecosystem but that fragmented, uncoordinated, and overlapping governmental action was also a prime cause. It argued that since many of the important coastal problems were of more than local interest, the state government was generally the proper level for management responsibility. In effect, what was

suggested was that the perspective on many of the problems of coastal resource management be raised from the local government level, where decisions are frequently influenced by such local matters as tax base, to the state level where, hopefully, a broader and longer-range view would prevail. A similar relation exists between state and national interests. Ways must be found to ensure that matters of coastal management that go beyond the concern of a single state, for example the national need for deep-water ports, are adequately met in the national aggregate of state programs.

THE LEGISLATION

On October 28, 1972, the President signed into law the Coastal Zone Management Act of 1972, assigning program responsibility to the Department of Commerce. Many of the recommendations of the Stratton Commission were incorporated into the legislation.

The Act's purpose is stated in Section 303, Declaration of Policy. Briefly, it declares that it is now national policy:

—To preserve, protect, develop and, where possible, to improve, our coastal resources;

—To help the states manage their coastal responsibilities wisely through the development of appropriate programs; and

—For federal agencies engaged in coastal programs to work closely with state, local and regional agencies in the development of programs. The Act further emphasizes that it is national policy to encourage cooperation among state and regional agencies, including the creation of agreements, procedures and joint action, particularly regarding environmental problems.

It is important to note that the Act, as passed, involves federal guidance and overview of the adequacy of the "process" contained within a state's proposed management program rather than the substance of individual land or water use decisions. In his signing message, the President highlighted this point:

> I will instruct the Secretary of Commerce to carry out this statute in a way which focuses federal efforts in the adequacy of state processes rather than to become involved in the merits of particular land use decisions.

However, given the comprehensiveness of the processes called for, a management program developed as a part of this program, will be able to achieve the broad purposes of the Act.

The Act, then, is intended to provide federal encouragement to coastal states, including those on the Great Lakes, to develop and operate coastal zone management programs. Two kinds of incentives are contained in the legislation. Firstly, financial assistance to states

is authorized. Three types of grants are established; to develop management programs, to operate approved management programs, and to assist states in the acquisition of estuarine sanctuaries. Secondly, once a coastal state has its management program approved by the Secretary of Commerce, federal actions (issuance of licenses and permits, etc.) that affect a state's coastal zone must be consistent with the management program. The grants authorized by the Act are on a ⅔ federal, ⅓ state matching basis, except for the grants for estuarine sanctuaries, which are ½ federal, ½ state funded.

It should be stressed that the CZM program envisaged by the Act is a voluntary one. No state is forced to participate and no sanctions are provided if states choose to stay out of the program.

It is also clear that the Act is primarily concerned with management of the coastal zone and involves the adjacent shorelands only in a limited way. Thus, the "coastal zone" to be managed under the program is defined as "the coastal waters (including the lands therein and thereunder) and the adjacent shorelands (including the waters therein and thereunder), strongly influenced by each other and in proximity to the shorelines of the several coastal states." This includes transitional and intertidal areas, salt marshes, wetlands, estuaries, and beaches. The zone extends, in Great Lakes waters, to the international boundary between the United States and Canada and, in other areas, seaward to the outer limit of the U.S. territorial sea (three miles). The zone extends inland from the shorelines only to the extent necessary to control shorelands, the uses of which have a direct and significant impact on the coastal waters. Federal lands are excluded.

The Act specifies that a state management program must include a definition of coastal zone boundaries, a list of areas of particular concern along with a list of priority uses within those areas, a proposed governmental structure for administering the program, and a method for controlling land and water uses within the coastal zone. Three types of controls are specified in the Act: (1) direct regulation by the state, (2) local regulation consistent with state-established standards, and (3) local regulation subject to state review.

In addition to providing for a review and approval process of state programs by the Secretary of Commerce, the Act establishes a 15-member national advisory committee. The committee as a group is to possess "a broad range of experience and knowledge relating to problems involving management, use, conservation, protection, and development of coastal zone resources."

The legislation strongly exhorts agencies and departments of the Federal Government to cooperate with states in the development and

operation of their management programs. Similarly, states are urged to use sub-state or inter-state entities in the development of the regional aspects of their programs. The Act also calls on both the state and the Federal Government to involve the "public" in the management program development process as fully as possible. We in NOAA firmly support the notion of active and frequent public participation in this work. We see at least 5 points where public involvement would appear to be appropriate and desirable:

(1) In the initial development of federal guidelines to administer the program.
(2) During the development of individual state programs.
(3) During the final program approval process at the state level.
(4) Participation on the Secretary of Commerce's Advisory Committee mentioned above.
(5) On similar advisory committees operating at the state level.

IMPLEMENTATION

Shortly after the Act was signed by President Nixon, the Secretary of Commerce assigned responsibility for its implementation to NOAA. I then established a task force to develop a plan for initiating the program. The task force has now been at work for slightly more than four months and has made what appears to me to be good progress.

It has taken on four major tasks during the initial months.

(1) *Inventory of the Present Status of CZM in the Coastal States*

We have found the situation grossly different from state to state as we attempt to establish a kind of "preprogram baseline." Many coastal states have taken some legislative steps to solve specific problems such as wetlands protection. Certain others are now in the process of beginning to formulate a CZ plan. A few, such as California and, to a limited extent, Delaware, have adopted moratoriums on certain types of coastal development until such plans are complete. But, with the possible exception of Washington and Rhode Island, few states have yet taken a comprehensive approach to the management problem. Preliminary indications are that essentially all of the coastal states are interested in the new federal program. Work continues on the formulation of a good information base on the existing situation in the several states (CZ legislation adopted or under study, organizational changes made or planned in connection with CZM, major CZ problems in each state, state-supported CZ research activities, etc.).

(2) *Development of Guidelines and Regulations*

Considerable effort has gone into the development of the guidelines and regulations needed for that part of the grant program that involves grants to states to develop management programs. The coastal zone task force drew up a rough working document and then called in a wide variety of general and special interest groups to help shape the guidelines into workable form. These groups were composed of representatives of state and local governments, planners, universities working with NOAA's Sea Grant program, federal agencies, user groups such as oil, electric, utility, and land developers, and environmental groups including Friends of the Earth, the Wildlife Management Institute, Sierra Club, and the Conservation Foundation. In this first set of guidelines, every effort is being made to insure that they will provide adequate direction to the states while remaining flexible enough to allow for differing state situations and needs.

(3) *Federal Coordination*

As a first step, we held a series of briefings to acquaint the rest of the federal establishment with the main provisions of the Act. A second round of more substantive discussions are now taking place with those agencies directly involved in the coastal zone. These have so far included HUD, EPA, several parts of the Department of Interior, and NSF (RANN). Considerable work remains to be done before all federally conducted or supported activities that could potentially affect a state's coastal zone can be considered to be adequately coordinated, however.

(4) *Assessment of the Technical Requirements of CZ Management*

We have also begun to look at the question of the informational needs of the state (and local) CZ manager. Even the best management program (new legislation, new organizational arrangements, revised procedures, etc.) will not achieve the overall goals of the program unless the users of the management program also have access to adequate information and understanding as to how the coastal zone actually works technically. In this connection, one thinks of such problems as the circulation of estuaries, longshore sediment transport, understanding the salt marsh ecosystem, barrier beach dynamics, beach stabilization, environmental carrying capacity and many others. Here we feel that the NOAA Sea Grant program can play and is playing a role. Also, many of the in-house programs of such NOAA elements as the National Ocean Survey, the Environmental Data Service and the Environmental Research Laboratories are present and potential contributors to meeting these needs. Other federally supported activities such as those of EPA, DOI, NSF, COE, and HUD are also important in this regard.

SUMMARY

While the new federal coastal zone management program is just now getting started, we are encouraged by the enthusiastic response from coastal states. All seem to recognize the urgent need to begin to rationalize the use of our unique coastal resources. Some states, Florida and Rhode Island, for example, have indicated their intention of moving toward federal approval of their management programs without waiting for specific federal grants for this purpose. Just when grant assistance will be available is not yet clear. In the meantime, we find that there is much to be done in preparing for the implementation of this important new program.

DISCUSSION

MR. WALTER SMALLEY: Mr. Chairman, I just want to share your opinion about Dr. White, because he and I are fellow members of the Oceanic Organization and I also want to publicly state—reports that I got from foreign governments and people in this country about the United Nations Conference at Stockholm, his was the most comprehensive report that I received.

Also, I spoke to him about the Marine Mammal Protection Act and perhaps he might like to make some comments about that.

DR. WHITE: I am not prepared to talk about that Act and its implementation. However, we regard that as a very new and important assignment for us but, as you know, the Act was passed during the last Congress and provides for a moratorium on certain species. The matter referred to, I assume, has to do with the importation of skins of marine mammals and these are being dealt with in public hearings. Judgments are being made as to whether indeed they fall under the Act, perhaps under the economic hardship clause. Mr. Smalley, I presume, is referring to the importation of a large number of seal skins. There will be public hearings in the near future.

MR. W. MASON LAWRENCE: When will the guidelines and regulations be available to the states and, in your work to date, have you determined the need for implementing legislation to the state to participate in programs as distinguished from legislation that may be desirable? There has been some suggestion there may be some state legislation that would be desirable merely to participate.

DR. WHITE: Well, I don't know the situation in relation to each of the individual states nor what state authorities exist in each of the states. Some may indeed have to pass legislation in order to provide themselves with the necessary mechanisms and authority to take advantage of the Act. Many states already have it.

As to the Guidelines having been completed, they have left the Department of Commerce and have been transmitted through the Office of Management and Budget for review. I hope we can have their comments and have them published the near future.

Also, as you know, we have made funds available for planning part of the implementation of the Coastal Zone Management Activity. No funds have been made available for the granting aspects of program at this time. Now, what we are finding is that many of the states, in conversation with us, are looking to a variety of possible sources of funding to begin to move ahead, even without formal funding through the grant provisions of the Act.

I indicated in my talk that some of the states are proceeding, even without the availability of federal grant funding, to prepare their own management plans, because there are many of the provisions of this act which are very beneficial to states in terms of relationship to the federal act. The President has made

provisions in the budget now before the Congress for funds in connection with land-use planning. If there is a passage of the Land Use Planning Act, we would hope we can participate with the Department of the Interior in using some of these funds for coastal zone planning.

MR. QUINN (South Carolina): I know that our Legislature is working out some of the mechanics so they can be prepared when funds are available under this act. Most states, as ours seems to be, have trouble defining the shoreline adjacent to the coast.

DR. WHITE: With the permission of the Chairman, I would like to ask Bob Knecht, who has been working closely with the states on this, to comment on this.

MR. ROBERT KNECHT: Could I amplify on an earlier answer to the gentleman's question from New York State?

It is our position that very few states have to take any legislative action to participate in the first phase of the program—that is to say, grant information. The governor designates a single point in the state to apply for grant money and that part of state government would then develop the progam planning efforts. We don't think legislation will be required in that instance.

With regard to the last question, definition of the coastal zone, our guidelines speak generally to this question. Those should be available within the next several weeks and those provide for states to consider this matter. As Dr. White mentioned, emphasis n ths act is on management of coastal waters, waters within the territorial three-mile limit and salt marshes and beaches, etc., and, to a very limited extent, those adjacent to shore lines. This was provided for in order to reduce the overlap with land-use legislation which is now being debated in Congress.

Shoreline consideration is limited in the Act to those shorelines uses that directly affect the coastal waters. Generally, we are leaving it to most states to decide how they wish to approach that problem. Some states may decide to take a limited view. Others may wish to take a more comprehensive view with regard to the amount of territory they wish to try to manage under the coastal zone effort. It is hard to be more specific in relation to this at this particular time.

We intend to provide another set of documents to the states, something beyond our guidelines and that represents a compendium of experience the states are feeling in this area in defining coastal zones, in terms of vegetation types, which may be useful in relation to definitional approaches.

We will be happy to discuss this matter with any individual state group in more detail at the appropriate time.

* * *

PROGRAM CRITIQUE OF THE 38TH NORTH AMERICAN WILDLIFE AND NATURAL RESOURCES CONFERENCE

LESLIE L. GLASGOW
Assistant Director, School of Forestry and Wildlife Management, Louisiana State University, Baton Rouge, Louisiana

My assignment to critique the conference offers a dreadful possibility for arrogance. I shrink from committing the "instant analysis" of a TV pundit. So I have read all the abstracts, some of the complete papers, and have attended as many sessions as possible. And although I have worked at various jobs in the natural resource area all my life, I still feel a bit shaky. On the other hand in my 50+ years on this planet, I have resolved in my own mind my own solutions for some of our complex environmental problems.

I must express appreciation to the program managers for graciously giving me permission to wander around through all the wisdom presented here over the past three days, picking brains and borrowing ideas at will.

I have been handed a permit to philosophize, which can be as dangerous as picking up a 6-foot untrussed alligator by the tail. And scars on my left hand bear witness to the fact that is dangerous. But please bear in mind, that if I steal something from an earlier participant, and distort his views, it ought not be held against him.

With that warning, here is one man's response to the conference theme of Natural Resources and National Priorities. This has been a good conference—among the very best—and there have been many fine papers presented; so many good ones I have had difficulty in determining which ones to highlight.

I thought it instructive to have it acknowledged that new owners and new uses of land are bringing about significant changes which may have been long overlooked.

Bitter disputes between developers and those who want things left as they are have become commonplace, and this is progress, for there must come a day of reckoning. That is the day when land use, whatever it may be, must be controlled. This planet has a carrying capacity which we cannot exceed. We have reached the point in many areas where delay in land planning means a deterioration in our human habitat and a lowering of our quality of living.

The enormous changes which the Disney people brought about at Orlando have altered many a life style in that part of Florida. The reaction has ranged from hosannas to outrage.

A corporation that wanted to put Disney's ideas to work in the Washington-Baltimore corridor found the opponents in Howard

County, Maryland, so powerful the county fathers barred its entry. So the firm moved to a location near Manassas Battlefield Monument and the neighbors there are sharply divided over whether to stage still another battle of Bull Run. I am sure each of you can cite similar confrontations in your own state. I agree with CEQ Chairman Russ Train who recently stated that land use is the Number One priority in the U.S. today. We have talked long and loud about land use, especially the coastal zone. It is time to forget who should author a land-use bill and move forward with the Jackson-Nixon proposal.

One of the villains is the vacation home movement. Although observers say it has peaked in certain areas, it gives every sign in the real estate advertising sections of still being a powerful force. Local agencies which have to contend with problems of water and sewage created by these new owners may not have the same regard for them as the tax assessor. You and I know that the proliferation of second homes, vacation homes, summer homes, mountain camp sites and the great open space hook-ups for trailers—plus the highways and other facilities to service them, are removing a considerable acreage of what used to be scenic land and wildlife habitat.

The real villains are land drainage and clearing—practices that often result in complete and permanent loss of valuable wildlife habitat.

We also know that new people bring in new habits and new viewpoints which are having powerful new impacts on natural resources. The old country ways seldom fit the life styles of the new residents.

And managers of natural resources also must make adjustments in our own methods to give consideration to this new urban army. By and large, they include a lot of people I would call protective types.

Some of the discussion this week on Human Dimensions in Wildlife reinforce my impression of the anti-hunting trend that has developed. The anti-hunters are continuing to gain converts. The attitude on deer hunting found in the Rutgers study of New Jersey people is prevalent all across the country.

The New Jersey Poll found that among the 517 who approve of deer hunting, more described themselves as mildly approving rather than approving strongly, while those who were against deer hunting, were more apt to rate themselves as disapproving strongly rather than disapproving only mildly.

Don't underrate them, the anti-hunter burns with a hot flame. And disapproval of hunting is growing, the studies show, among young people, urban residents, and people who have no association with

hunters. You and I preach to each other while the other side is out preaching to people open to persuasion.

I have voiced my fears so often about the anti-hunting movement that I qualify in my adversaries' opinion as a certified kook on the topic. I say again we had better do a much improved job of getting our story across.

We ought to take to heart the blunt assessment in the paper from Alaska: "When the controversy over the morality of hunting emerges in public debate, hunters tend to be poor spokesmen for their cause."

I hope the people who decide the future of hunting as well as the future of all our renewable natural resources will be the intelligent men and women of all ages, who once they have the facts, are quite competent of coming down on the right side. The trouble is they are being bombarded from every direction with misinformation from the irrational preservationists. These careless, emotional people are having their inning at bat, but they will surely strike out sooner or later. We must redouble our efforts to see that ecological truths reach the average person.

In the wildlife area, the know-nothings are increasing their advantage over the scientist. Science itself, and technology are becoming dirty words in the glib jargon of the instant ecologist. We may have to suffer through a period of faddism for a while longer before common sense returns to the scene.

But I do not join the pessimists who feel we have already lost the ecological education war. On the contrary, I am more optimistic than many, and perhaps because of my bias as an educator, I am convinced we can do wonders through solid education.

We are not going to do it, however, by eternally telling each other that we are God's gift to wildlife because it is our license dollars that have preserved the habitat which enables wildlife to survive.

As a general rule, the wildlifer's cause is well understood and nearly always championed by the outdoor writers of the press, and by those in television who present programs built around hunting and fishing.

But the great bulk of the news passes through the hands of the news editors, local, state, and national editors, wire editors, foreign editors and their many staff people. A paragraph once a week back in the Rod and Gun column is not going to offset the barrage of anti-hunting material which surfaces in the other pages—including most certainly the society section or the women's pages.

We ought to be making more of an attempt to educate those people, and the program managers and producers of TV shows that have such an overwhelming impact on viewers.

More importantly, the conservation education campaign ought to be concentrating much more than it does on the nation's school systems. We should be reaching the children early in the elementary schools, and sticking with them right up to graduation day.

Before the little ones can be reached, however, their educators have to be educated. Conservationists are smart enough to figure ways of reaching and teaching the teachers, or my optimism is sorely overextended and the pessimists are correct. Some of the programs already in progress are great, and merit copying. But they are something to build on, not rest on.

School curricula are so packed with courses now that it will take an imaginative shoehorn to squeeze in new ecological subjects. But we must get them in somewhere. Some situations will permit them to be included in science and other existing courses.

The courses will have to be carefully and skillfully prepared so they cannot be mistaken as frills and get junked. Education in conservation, the environment, ecology—whatever the going phrase may be—must be able to compete for time with other scholastic subjects. Teachers are not going to sacrifice precious class time from the 3R's to tell kids what great guys we hunters are.

And speaking of competition—let us consider that most horrifying obstacle course in the nation's capitol, strewn with the whitened bones of once valorous challengers, the Office of Management and Budget.

Much has been written in the press about budget impoundments by the President. I think the President is to be commended for his attempt to reduce the total federal budget for this current fiscal year by about $20 billion. Impoundment of fish and wildlife funds amounts to about $3 million. Supposedly the $3 million is placed in reserve and will be available in subsequent years.

The program most affected is one of my favorites—land acquisition. This action will at least defer the purchase of about 8,000 acres out of a 94,000-acre program. But I doubt that the $3 million will ever be spent for land acquisition. I know from first-hand experience that OMB does not look with favor on the purchase of lands for wildlife.

A look at the President's '74 budget for fish and wildlife reveals that no advance was requested for acquisition of refuges; thus a further reduction of $7,100,000 is contemplated.

It is axiomatic that land acquisition deferred this year will cost proportionately more next year and with scarcely any exceptions whatever, will cost a great deal more 10 years from now. The record is stuffed with examples of true stories of how much money could have been saved if only parcel "X" had been bought a couple of years earlier.

The real financial problem in the Bureau of Sport Fisheries and Wildlife over the years has been inadequate funding of program responsibilities that are continually being added by the Congress. In my opinion, the Bureau is overcommitted. No one has convinced the Federal Government of the importance of properly funding wildlife. This points up the urgent need to make wildlife values known to the Office of Management and Budget and to the Congress.

The normal budget process is tough. I went through two full cycles and I know the Bureau is doing a good job formulating its program and justifying it. Its problems are much the same irrespective of whether there is a Republican or Democrat in the White House. In fact, Congress has historically given the Bureau more than the President has requested for it.

The Bureau needs outside help—your help. We must take a more active part in urging adequate funding. We must make ourselves heard and exercise all the persuasion we can to convince the President, the Congress and the OMB that the Bureau of Sport Fisheries and Wildlife should receive a larger share of the federal budget. To do less is to fail to discharge our responsibilities to ourselves and to wildlife.

In times of tight money, wildlife and recreation usually suffer. As a student of bureaucracies—not only governmental ones—I know how difficult it is on the man in the field trying to make the operation work. And when he simultaneously has to contend with personnel and functional reorganizations, no wonder he is struck with confusion and near despair.

Wildlife managers need long-range programs which they can bring into reality a piece at a time, in orderly progression. They need to operate within a logical framework. For example, I know how difficult it is for the administrators of management areas in Louisiana—one of the wettest states of all—to be grouped in with the arid areas of the Southwest.

I do recognize the national needs that argue for grouping of responsibilities on other than ecological grounds. And like every other law-abiding taxpayer, as the Internal Revenue hour draws near, I am very aware of the national financial difficulties.

Having acknowledged these painful facts of life, I want to reemphasize my concern that we are failing to do enough in the way of land acquisition for not only endangered species but also for many species whose habitat has been so drastically reduced from many causes, not the least of which is subsidized drainage and land clearing by government agencies.

A few years ago I was in New Delhi at a meeting of the IUCN. It

upset me then, as it did many other professional biologists, to see such euphoria on the part of so many who obviously believed that if an animal could only win a place on the official roster as rare or endangered, its salvation was automatically assured.

The same sort of misunderstanding continues today in the U.S. The general public has been led to believe as an article of faith, that once an animal makes it into the Red Book, it has been snatched from the jaws of extinction.

Such a listing by itself is no more of a guarantee of permanence than for a man to make it onto a list of presidential appointees. The latter roster, as many of my brethern could join in testifying, is fraught with temporariness and even brevity.

No, it is not winning the badge of endangered which does the job; habitat preservation is the key to survival for all species and it may require land acquisition. But habitat preservation is not necessarily synonymous with governmental land acquisition. Some of you have heard me before on the subject of the alligator, and the danger of protecting it to the point where it becomes untouchable.

The alligator is an unique part of our native wildlife heritage in the South and an integral part of our environment. But the alligator restored to desirable populations becomes a valuable economic benefit to the landowner. When we provide a profit incentive for the landowner to maintain 'gator habitat, we have used the most persuasive weapon in our arsenal to perpetuate the species. And think of how much we help other marsh wildlife. And it does not require the expenditure of any public funds. On the contrary it brings in revenue to the public coffers and to the landowners.

If we forbid the landowner any opportunity at all to cash in on the 'gator he has guaranteed living room for, the landowner sooner or later is going to find a way to dispose with him. The marshland owner is willing to let the 'gator feed on his muskrat and nutria so long as the alligator represents an eventual repayment of the investment. Take away the repayment and the man who owns the land is going to find a way to cash in on the nutria and muskrat instead.

I was glad to hear that other heretics on the program agree that some endangered species can be perpetuated forever if we make it worthwhile in a commercial sense for their nongovernmental propagators.

Even as the alligator must be kept in balance with its environment so much our own species be brought into balance on a worldwide basis. For human population is central to any consideration of natural resources and national priorities. Beyond national concerns the global population cannot be considered separately; the have-not

nations, unable to bring their starving masses under control, are a threat to the resources of all nations.

Only a couple of years ago India thought it was nearing self-sufficiency. Now she is once again importing grain, and her population is growing by about 13 million people a year. This annual increase is outstripping India's ability to increase grain production. In India and many countries the only hope is a massive education program which can convince them to reduce the birth rate. All countries should stabilize their populations. Failure to do so will further aggravate our already serious social, environmental and resource problems. Therefore, population control should continue to receive high priority in our planning.

Let me return for a moment to Interior. As Assistant Secretary, I championed states rights and was successful in convincing the Secretary to adopt a new policy of cooperativeness with the states. And although this policy still prevails, I see examples of weakness on both sides. I said at the time of adoption, that this new partnership was a two-way street and if it is to thrive the street must be traveled—both ways. So I urge state and federal agencies to rededicate their efforts to this cooperative relationship.

The days ahead will continue to produce new challenges to us as managers of living resources.

In my opinion our obligation to the people and the resources will best be accomplished by the two-way street philosophy, whether it is the state vs. federal management or by the managers vs. extreme preservationists. If it shocks you to consider even the possibility of negotiating with the more rabid preservationists, ask yourself whether ignoring them will really make them go away.

CLOSING REMARKS

LAURENCE R. JAHN
Chairman, Program Committee, 38th North American Wildlife and Natural Resources Conference

Les, we are indebted to you for that fine critique of the 38th North American Wildlife and Natural Resources Conference. Your statements help all of us place in an overall perspective the knowledge gained at the individual sessions. We appreciate your concentrated efforts in producing that enlightening statement.

Many other individuals have contributed immensely to this successful international conference. Vice Chairman Terry A. McGowan of The Wildlife Society has been most helpful, as have all members of the Program Committee, in planning and staging the several activities in which we have participated during the past few days.

Many other individuals assisted in providing the accommodations, facilities, and services required to make this conference a pleasant and rewarding experience. Their outstanding contributions either have or will be acknowledged personally in the near future. Through their efforts 1,403 people were registered. Total attendance was something larger, as some people did not register.

Next year the conference will be held in Denver, Colorado from March 31 through April 3. The Conference Program Committee will meet next month to begin to develop the agendum for the 1974 meeting. Your constructive suggestions for topics and speakers to highlight critical international, national, and western regional resource problems are invited and will be appreciated. But please remember, forward them to me soon.

On behalf of the Wildlife Management Institute, many thanks for your participation. This has been a rewarding conference. Have an enjoyable and safe journey home.

The 38th North American Wildlife and Natural Resources Conference stands adjourned.

REGISTERED ATTENDANCE

ALABAMA

Hobson Bryan, W. L. Holland, Raymond D. Moody.

ALASKA

Edward A. Bellringer, Joseph R. Blum, A. W. Boddy, Mrs. Thelma Boddy, D. S. Braden, Harry E. Carter, Frederick C. Dean, Victor Fischer, James E. Hemming, Ben Hilliker, Celia M. Hunter, Joe Josephson, David Klein, Tom Kohler, Gene Ludlow, Urban C. Nelson, Sig Olson, Michael C. T. Smith, Don H. Storde, Robert B. Weeden.

ARIZONA

Elaine Adams, Jack Adams, Ariel Appleton, Frank Appleton, Robert D. Curtis, Hugh Downs, Ruth Downs, Steve Gallizioli, Robert A. Jantzen, Lawrence E. Powell, Evelyn M. Pratt, Jerome Pratt, Norman S. Smith, Dianne Winter, N. A. Winter, Jr., Peg Winter.

ARKANSAS

Robert E. Apple, Richard W. Broach, David G. Criner, Rex Hancock, Pratt Remmel, Jr., Donel Whiting, Steve N. Wilson, Mrs. Steve Wilson.

CALIFORNIA

Ray Arnett, David R. Brower, Arthur H. Carhart, John Chatellier, R. E. Devol, Joy Carhart Fuenzalida, Bob M. Gale, Mrs. R. M. Gale, Seth Gordon, Walter E. Howard, Huey D. Johnson, Louis D. Jurs, Kent E. Kroonemeyer, A. Starker Leopold, E. W. Mertens, Frank Montalbano, Lewis Nelson, Jr., William Radtkgy, Thomas W. Riley, Barry V. Schneegas, Edward R. Schneegas, Mrs. E. R. Schneegas, Vern Smith, Elizabeth Speers, Ronald T. Speers, Marv Switzenberg, Gary C. Wakefield, Sandy Wakefield, Jaclyn H. Wolfheim.

COLORADO

John Bain, Pete Barrows, Susan Barrows, Del Benson, Kay Collins, Eugene P. Cook, John E. Crawford, Alexander T. Cringan, Paul Cuplin, Robert W. Davis, Eugene Decker, Richard Denney, M. I. Dyer, Robert L. Evans, D. L. Gilbert, William D. Graves, A. F. C. Greene, Jack R. Grieb, Jack E. Gross, Ralph R. Hill, Mrs. R. R. Hill, Bob Hoover, Dick F. McDonald, M. A. Marston, Ed Merrick, Jim Miller, Edwin H. Montgomery, Wayne W. Sandfort, John L. Schmidt, Thomas G. Scott, Dale Stahlecker, Gus Swanson, Robert K. Turner, Dale A. Wide, Richard G. Walch, Roberta Winn.

CONNECTICUT

John M. Anderson, Evelyn Bampton, Theodore B. Bampton, Jane Barske, Philip Barske, Mrs. Philip Barske, Gary E. Belovsky, P. H. Burdett, Mrs. P. H. Burdett, George A. Chandler, R. C. Clement, Alfred J. Hunyadi, Mrs. Alfred J. Hunyadi, Annie Hunyadi, Martha Hunyadi, Peter A. Jordan, Jack F. Kamman, Leonard Lankford, Jr., J. P. McAndrews, E. S. McCawley, Jr., Richard S. Miller, Warren Page, H. E. Puffunbarger, Peter Seligmann, M. L. Sharrah, James H. Shaw, William E. Talley.

DELAWARE

Richard Cole, William K. DuPont, Darrell E. Louder, Mrs. Darrell E. Louder, James R. Steinhauer, Thomas Taylor, Gene Whitaker, Bette Wilder, Norman Wilder.

DISTRICT OF COLUMBIA

Wendy Adler, George Alderson, Thomas B. Allen, Frank Ansuini, Mrs. Ellis Armstrong, William Bailey, Clark P. Baker, Richard C. Banks, Thomas E. Bass, Roger R. Bay, Clark R. Bavin, Mrs. Norman Berg, Vic Berry, Mrs. Vic Berry, Wayne H. Bohl, Stewart M. Brandborg, I. L. Brisbin, M. E. Britton, Evelyn Brown, Betty Brubaker, P. A. Buckley, Robert Cahn, Virginia Carney, James Carroll, William Cherry, Mrs. Frank Church, Louis S. Clapper, Jan Clarkson, Robert E. Cleary, Henry Clepper, Wymberley D. Coerr, Mrs. W. D. Coerr, George Coling, Ben H. Crabb, James B. Craug, Robert K. Davis, James G. Deane, Elliott Degraff, Robert T. Dennis, Phil Douglas, William J. Duddleson, Philip A. Dumont, James T. Dwyer, Arthur Eck, Merrill Englund, Mrs. Merrill Englund, James O. Evans, Mrs. James O. Evans, Fred J. Evenden, Rebecca Ewing, Jennifer Ewoldt, Kathy Fahey, Dexter Faulkner, David Finnegan, Mrs. David Finnegan, Joseph L. Fisher, Ann Cottrell Free, Harry M. Fox, Hardy Glascock, Lesley Glatt, Marvin Gordon, Guy A. Greenwell, Max

Gruenberg, Mrs. Max Gruenberg, C. R. Gutermuth, Mrs. C. R. Gutermuth, Donald Harper, Mrs. Donald Harper, Ronald Harper, Van T. Harris, Bernard Hartung, Mrs. Bernard Hartung, Mike Harvey, Mrs. Mike Harvey, Donald Hary, Keith Hay, Albert Eugene Hester, Dorothy Hetrick, Gary L. Hickman, A. Marie Hickman, Sandy Hobbs, Jan Holderness, Nicholas R. Holler, Fred E. Hornaday, George Huber, Mike Hudoba, Mary A. Huffer, Ray Hunter, John Hussey, Mrs. John Hussey, Robert H. Hutton, Larry Hygren, Phineas Indritz, Mrs. Phineas Indritz, Sharon L. Jackson, Laurence R. Jahn, Mrs. Laurence R. Jahn, D. J. Jamison, Dale W. Jenkins, Walter E. Jeske, John C. Jones, Robert E. Jones, Stephen L. Keiley, Virginia Keiley, Francis X. Kelly, Hugh Kelly, Mrs. Hugh Kelly, James Kendall, Mrs. James Kendall, J. Howard Kerby, Susan Kernan, Thomas L. Kimball, Mrs. Thomas L. Kimball, Willis King, Robert W. Lamson, John R. Langenbach, Paul A. Lenzini, Ross Leonard, Mrs. Ross Leonard, Charles Leppert, Mrs. Charles Leppert, Richard Lewis, Linda Liegahn, James Lindsay, Joe Linduska, Lillian Linduska, Robert M. Linn, Harrison Loesch, Mrs. Sidney Loesch, William M. McCredie, Sidney McFarland, Mrs. Sidney McFarland, Terry McGowan, Mrs. Terry McGowan, Bette McKown, Eileen Maksymiec, R. T. Marks, Clifford Morrow, Elizabeth Morse, Nan Muckenhim, Louise Murville, John R. Olive, Carol Peddicord, Ronald W. Peddicord, C. Boyd Pfeiffer, Daniel A. Poole, Mrs. Daniel A. Poole, Kathy Poole, Nancy Poole, Wynn Poole, Richard S. Pospahala, Nancy Pratico, Sue Pressman, Nell T. Prior, Hamilton K. Pyles, Mrs. Hamilton K. Pyles, Nathaniel P. Reed, Mrs. Nathaniel P. Reed, Mrs. Dwight Rettie, John E. Rhea, Phyllis Rock, Estuardo Rodriquez, William F. Royce, Mrs. William D. Ruckelshaus, George C. Ruhle, Pete Samsell, Felipe Sanfuentes, Dan Saults, Susan Saylor, Al Schacht, Alex Schnee, Charles M. Schwartz, Dixie Scott, William L. Shafer, Mrs. William L. Shafer, Elmert W. Shaw, Mrs. Robert L. F. Sikes, Jerome F. Sitter, Mary Slattery, Walter B. Smalley, Mrs. Anthony Wayne Smith, Spencer H. Smith, Mrs. Spencer H. Smith, Spencer M. Smith, Jr., Leonard H. Springer, Samuel Stanley, Marshall L. Stinnett, Philip J. Stone, Dick Stroud, John B. Sullivan, Dottie Taylor, Mrs. Roy Taylor, Keith B. Thompson, Virginia Towell, William E. Towell, Mrs. Thurman Trosper, Bill Van Tries, Jerry Verkler, Mrs. Jerry Verkler, Drew Von Bergen, Richard A. Wade, Mrs. Ronald Walker, Elizabeth S. Wallace, Mrs. James G. Watt, Mrs. Vee Weggel, Beatrice E. Willard, Cheryl R. Williams, Lonnie L. Williamson, Pat Williamson, Robert Williamson, Adele Wilson, Cynthia Wilson, Don E. Wilson.

FLORIDA

Herb Alley, Robin H. Fields, Earl Frye, Larry D. Harris, Val Johnson, C. Eugene Knoder, Roy Komarek, Robert F. Ribinski, Mrs. C. D. Shoemaker, George P. Spinner, Julia A. Spinner, Gordon Spratt, Alexander Sprunt IV, H. E. Wallace.

GEORGIA

W. Carlyle Blakeney, Jr., C. Edward Carlson, Dorothy B. Carlson, Jack A. Crockford, Betty Edwards, Malcolm G. Edwards, Leonard E. Foote, Mrs. Leonard E. Foote, Ronald L. Fowler, Robert N. Gashwiler, Frank A. Hayes, Howard A. Miller, Mrs. Howard A. Miller, Ernest E. Provost, Samuel Pursglove, Robert T. Seagrest, Henry R. Smith.

HAWAII

. . . . .

IDAHO

H. Jack Alvord, E. Kliess Brown, Ernest E. Day, A. J. Eiguren, Joseph C. Greenley, Kenneth E. Hungerfold, R. G. Kalb, Paul C. Keeton, Don H. Shuler, Doyal Stiles, Roger M. Williams.

ILLINOIS

Judy Adams, Lyle L. Adams, William L. Anderson, George Arthur, George V. Burger, Wesley M. Dixon, Dave Erickson, Ed Hoffman, Samuel R. Jewell, Miriam Klimstra, W. D. Klimstra, William B. Klimstra, Edward L. Kozicky, Ronald F. Labisky, James M. Lockart, Miles P. Locke, Ken McCreary, Hannah Parsons, John David Parsons, Karen Parsons, Frederick C. Pullman, R. C. Rittenhouse, Glen C. Sanderson, J. Henry Sather, M. Douglas Scott, Dale E. Whitesell.

INDIANA

Dorothy H. Allen, Durward L. Allen, Kathy Barbour, Gene Bass, Lynton K. Caldwell, Peggy Cooley, Roy B. Crockett, Kim Fisher, Scott Fisher, O. D. Gallimore, Sandra Ann Gallimore, Connie Geiger, Mary A. Gossard, Pat Hamilton, Lewis Huston, Bob Kern, C. M. Kirkpatrick, Gail Kirkpatrick, Kim McKenzie, Ann Miller, William J. Napier, Mrs. William J. Napier, Joe Pompan, Marilyn Priddy, Charles E. Scheffe.

IOWA

Robert Barratt, Harry M. Harrison, Gene Klonglan, Sylvia Klonglan, Fred A. Priewert, Max Schnepf, Edward Weinheimer.

KANSAS

George C. Halazon, Ron Klataske, John N. Luft, Chester B. Rideout, Robert J. Robel, Marvin D. Schwilling, Fred Sears, Richard D. Wettersten, Gary L. Worthen.

KENTUCKY

Joe Bruna, Bernie Carter, Albert H. Henson, Coleman Holt, Arnold L. Mitchell, Dolores B. Schwartz, James Alan Schwartz, Robert C. Webb.

LOUISIANA

J. Burton Angelle, L. L. Glasgow, Joe L. Herring, Charles D. Kelley, Kenneth C. Smith, J. Ross Vincent, Dick K. Yancey.

MAINE

Kenneth H. Anderson, Malcolm W. Coulter, Owan C. Fenderson, A. H. Garcelor, Frederick B. Hurley, Jr., Mrs. F. B. Hurley, Jr., Carl Korschgen, Glenn H. Manuel, Howard L. Mendall, Ray B. Owen, Jr., William C. Reed, Sanford D. Schemnitz, Howard E. Spencer, Jr., John E. Wood, Michael D. Zagata.

MARYLAND

Robert Abraham, Spencer R. Amend, David R. Anderson, John Andrews, Ralph Andrews, Michael J. Apperti, Thomas S. Baskett, William G. Bauer, Earl Baysinger, Mrs. Earl Baysinger, Edward V. Berard, Ralph A. Bitely, Robinson Blitz, Carl W. Buchheister, Mabel H. Buell, Noble E. Buell, Bruce R. Bury, Charles L. Cadieux, Mrs. Charles Cadieux, Samuel M. Carney, C. G. Carothers, O. J. Cartwright, Carol Cassell, Christopher R. Cassell, Roy A. Castle, Joseph A. Chapman, Walter F. Crissey, Eugene L. Cronin, Stuart Davey, Arthur Dierker, Ethel H. Dolnick, Evelyn E. Eader, Howard H. Eckles, Quentin A. Edson, Dean F. Eitel, Howard R. Erickson, Ray G. Erickson, Philip Etter, R. C. Farentinos, Ronald J. Field, Vagn Flyger, E. Hugh Galbreath, Alfred D. Geis, H. Ken Germroth, Thomas P. Goff, Jr., James R. Goldsberry, Robert W. Grant, Mrs. Robert W. Grant, Lynn A. Greenwalt, George Grossette, Ralph C. Hammer, Steve H. Hanke, Edward Hanks, Claudine M. Hanson, Lynn E. Hanson, John M. Hefner, Clare W. Hendee, Charles J. Henny, Carlton M. Herman, Mrs. Carlton M. Herman, Earl H. Hodil, Sydney Howe, Carol A. Hurst, Dorothy Boyle Huyck, Janies W. Johnston, Jr., George Jonkel, Jean Jonkel, Gary Kalin, Charles F. Kimball, Malcolm E. King, Melvin Kleen, Daniel L. Leedy, Chuck Lobdell, William Edward Long, Loren W. Lustig, Thomas Lutton, Duncan MacDonald, Frank McGilvrey, John R. Maestrelli, Whitfield Mallory, Mrs. Whitefield Mallory, Merle H. Markley, Kahler Martinson, Patricia Mehlhop, William H. Meyer, Charles H. Milton, Jr., Verna Mize, Phillip Mohler, Robert E. Munro, Marvin S. Myers, Henry F. Nichol, Patrick F. Noonan, Robert T. Novotny, Daniel A. Panshin, Tom Parisot, W. W. Allen Peterson, Mike Pfetsch, Harriette Phelps, Leroy Pool, Charles Potter, Henry M. Reeves, Eleanor C. Robbins, Caldwell C. Robinson, Richard Rodgers, John P. Rogers, James T. Roseberry, Robert ublemann, James L. Ruos, Albert Sanderson, Joshua L. Sandt, Vic Schmidt, Keith M. Schreiner, Robert F. Scott, Steve Seater, John Serafin, Brian Shapp, Jay M. Sheppare, Joseph C. Shugars, F. William Sieling, Ronald O. Skoog, William S. Sladen, Glen Smart, Linder Smith, Steve Smith, Stephen F. Specht, Harry W. Staley, James Stevenson, Margaret C. Stevenson, David A. Stiles, Milton P. Storey, Vern Stotts, Clair E. Terrill, Zola M. Terrill, Darwin H. Tobing, Eva H. Turner, Helen L. Webster, Susan Weck, Stanley Wiemeyer, Robert R. Wilson, R. Bruce Zeisel, Regina B. Zeisel.

MASSACHUSETTS

William D. Borchers, Richard Borden, Martin K. Bovey, Mrs. M. K. Bovey, Carl A. Carlozzi, Harold J. Coolidge, Lawrence K. Genander, Fred Greeley, Richard Griffith, Wayne Hanley, Eleanor C. J. Horwitz, Joseph S. Larson, Don R. Progulski, Bill Sheldon, James M. Shepard, Les Smith, Bill Sweney, Jack Ward Thomas, Margaret Thomas, Lynn Walsh.

MICHIGAN

Carol Abbey, Charles G. Abbey, Louis A. Abbey, Penny Ancel, Jack D. Bails, Dennis O. Baker, John R. Bassett, John A. Bissonette, Edward H. Brown, Jr., Mrs. Edward H. Brown, Jr., Greg Buhyoff, John O. Cartier, Archibald B. Cowan, Raymond Croteau, Donald W. Douglass, Mrs. D. W. Douglass, B. L. Driver, Edward J. Gates, A. Gene Gazlay, Maxine Herbert, Paul A. Herbert, Jack Kause, John H. Kitchel, Richard Knopf, Justin W. Leonard, Louis D. McGregor, Jerome Maslowski, Thelma Maslowski, Robert Milne, Muriel E. More, Thomas A. More, Jean H. Petoskey, Merrill L. Petoskey, Gordon Rockwell, Branch L. Ryan, Jr., Mrs. B. L. Ryan, C. Dietrich Schaaf, William Shaw, Norman F. Sloan, Daniel R. Talhelm, R. D. Van Deusen, Douglas Wellman.

MINNESOTA

Edward M. Brigham III, Mike Casey, Robert L. Herbst, James Jack, Robert L. Jessen, Edward Landin, Margaret Landin, Martin Magnuson, Leitle C. Marshall, William H. Mar-

shall, Maynard Nelson, Laura Roberts, Travis S. Roberts, Ron Schara, Bill Stevens, Ettik Wiese.

MISSISSIPPI

Dale H. Arner, Mrs. Dale H. Arner, Wendell J. Lorio.

MISSOURI

John T. Brady, Allen Brohn, Paul Brooks, Virginia Brooks, Odell Crader, Bill T. Crawford, William H. Elder, Leigh H. Fredrickson, John L. Funk, Larry R. Gale, Robert R. Germany, Edwin H. Glaser, James L. Hansen, Bert Hicks, David D. Hurlbut, A. B. Jackson, Chris Kelly, Joan Kelly, Sherman Kelly, Bernice M. Korschgen, Leroy J. Korschgen, Mike Milonski, Carl Noren, Charles A. Purkett, Dick Rotsch, Kenneth C. Sadler, Rollin Sparrowe, Ed Stegner, Ken Tlicks, Harold G. White, Patricia Ann White.

MONTANA

Don Aldric, Mrs. Don Aldric, Rodger Bumstead, Robert L. Eng, Ray A. Heady, Willis B. Jones, Don McIntosh, Richard J. Mackie, C. J. Martinka, Bart W. O'Gara, W. Leslie Pengelly, Robert Ream, Arnold Reider, George H. Stankey, Wesley R. Woodgerd.

NEBRASKA

William J. Bailey, Willard Barbee, Don O. Bridge, Arthur D. Brown, Norman Dey, Wade H. Hamor, Kenneth L. Johnson, James H. McNair, Jean McNair, James M. Malkowski, J. Reid Neil.

NEVADA

Virlis Fischer, Frank W. Groves, Jim Yoakum.

NEW HAMPSHIRE

Thomas Lea Davidson, Earl R. Jette, Allen A. King, Gerri King, William W. Mautz, Ruth G. Merrihew, Julia Strong, Karl F. Strong, Kathryn Strong.

NEW JERSEY

Carol S. Applegate, James E. Applegate, Russell A. Cookingham, Major Deck, Grace E. Godley, Raymond Hinkley, Robert C. Hughes, E. Budd Marter III, Martha M. Marter, Susan Monaghan, Edward Nottage, Ted S. Pettit, Carl H. Thomas, Mary Thomas.

NEW MEXICO

Raymond J. Buller, William S. Huey, Dale A. Jones, John W. Mumma, Bill Nelson, J. Morgan Smith.

NEW YORK

Philip U. Alkon, Philip Allan, James D. Allaway, Deborah Appel, Thomas Attridge, Jr., Chaplin B. Barnes, John Battle, Richard J. Born, Frances Breed, James Briggs, Sue Briggs, Lawrence Brown, Tommy L. Brown, Amy Callison, Charles H. Callison, Grace P. Christy, Andrew Clauson, Rod Cochran, Donn E. Critchell, Richard Dworsky, David L. Euler, W. H. Everhart, Robert M. Ferguson, Mrs. Robert M. Ferguson, John L. Franson, Lawrence S. Hamilton, Harry L. Hampton, Jr., John D. Harder, Douglas Hill, Sylvia C. Hilts, William R. Hilts, W. K. Jenkins, Mrs. W. K. Jenkins, Ivan T. Johnston, Jerry Kenney, Bente Starcke King, Anne Labastille, W. Mason Lawrence, Sara E. McGlinchy, Richard J. McNeil, Stephen McRae, Charles Mason, Mrs. Charles Mason, Robert L. Miller, Rowena L. Miller, Aaron N. Moen, Barre Mohammed, Ruth Monson, George Narita, Hans C. Paller, Harrison H. Payne, Polly Plaza, S. Scott Porter, Richard H. Pough, J. Stanley Quickmire, Patricia Rambach, Martha E. Reeves, Milo Richmond, James C. Rikhoff, Aline Romero, Forrest S. Romero, Robert Ruthman, Joseph J. Shomon, Mrs. Joseph J. Shomon, Tannah Sobel, Elvis J. Stahr, James Tate, Jr., Daniel Q. Thompson, Richard S. Thorsell, Robert Tillman, Jeffry Vonk, William W. Wakefield, Bruce Wilkins, Sandra Wilkins, Ed Zern, Evelyn Zern, Tim Zorach.

NORTH CAROLINA

F. S. Barkalow, Jr., Dennis B. Griffith, Don W. Hayne, Stuart A. Marks, Clyde P. Patton, Lucile Patton, Bill Rogers, Ann G. Samsell, Eugene E. Schwall, Kenneth A. Wilson.

NORTH DAKOTA

Gerald H. Cross, Keith W. Harmon, Mrs. Keith W. Harmon, Arthur D. Mortvedt, Harvey K. Nelson, Russell W. Stuart.

OHIO

Lowell W. Adams, Dan Armbruster, Carole Bittner, Dave Bittner, Howard W. Braham, Robert J. Clements, Roger L. Collins, Doug Forsyth, Jon Ghiselin, E. E. Good, Robert Hoffman, Ron J. Johnson, Jean Kandrac, George Laycock, Jacob W. Lehman, Tony J. Peterle, Charles V. Riley, Jim Robey, William A. Tolin, Gary White.

OKLAHOMA

Jack Barclay, Lyndol Fry, Carrol L. Henderson, Ethelle M. Henderson, George Hulsey, Willis Lansden, Mrs. Willis Lansden, Letha Lawver, Mervin Lawver, Jane Morgan, William Morgan, David R. Stickland, Glenn Titus, Buena Vieth, Elmer Vieth, Dick Williomson.

OREGON

Enoch Bell, Robert L. Borouicka, John Chattin, George J. Eicher, Anne Findlay, John D. Findlay, Dayton O. Hyde, Fred N. Koehler, John W. McKean, L. Dean Marriage, E. Charles Meslow, William B. Morse, Norma Faye Neitro, William A. Neitro, George Reed, P. W. Schneider, Frank Stanton, Lee Stanton.

PENNSYLVANIA

Robert Anthony, Maurice I. Arnold, Glenn L. Bowers, Albert M. Day, Mrs. Albert M. Day, Richard J. Clark, Richard Coon, John F. Eveland, Robert E. Fasnacht, David M. Forney, Victor C. Funk, Linda K. Gantt, John L. George, J. George Gleich, Jerry Hassinger, Alan C. Havens, Robert Hicks, Clyde R. Houseknecht, Willard T. Johns, A. Scott Krug, James S. Lindzey, Bob Maestro, Brian D. Moreth, Jim Nelson, M. Graham Netting, Thomas L. Nickeson, M. Alicia Peel, Michael V. Puglisi, Terry D. Rader, Lanny W. Reed, E. M. Rinehart, Mrs. E. M. Rinehart, Harvey A. Roberts, Carl W. Schwartz, Samuel P. Shaw, Dale E. Sheffer, Don Snyder, Rebecca Faith Surdick, James A. Thompson, Mrs. James A. Thompson, Lee Tibbs, Robert G. Wingaid, C. C. Winter, Mrs. C. C. Winter, Al Woolf, Bonnie Woolf, Donald E. Zimmerman, Mrs. D. E. Zimmerman.

RHODE ISLAND

R. C. Frederiken, Frank C. Golet, Alfred L. Hawkes, Bonnie Murphy, Dennis J. Murphy, Jr., James E. Myers, Marty Myers, Clarence M. Tarzwell, Donald J. Zinn, Mrs. Donald J. Zinn.

SOUTH CAROLINA

F. Baytow Culp, Fred W. Kinard, Jr.

SOUTH DAKOTA

John M. Gates, Bob Hodgins, Charles E. Keeler, Ray Linder, John Popowski, J. H. Shaeffer Lloyd F. Thompson, Victor Van Ballenberghe.

TENNESSEE

C. Holden Brink, James H. Burbank, Anthony J. Campbell, L. Robert Curtis, Gordon E. Hall, Frank R. Holland, Chester A. McConnell, John L. Mechler, Anne B. Ripley, Thomas H. Ripley, Charisse Taft, Eileen Taft, Kingsley A. Taft, Jr., Lynette Taft, Rosa Taft, E. Harold Warvel, Robert F. Williams, Stephen S. Wilson.

TEXAS

Ernest D. Ables, Sam L. Beasom, Michael E. Berger, Stephen Berwick, Lytle H. Blankenship, David R. Blankinship, Glenda Blankinship, Ruth Blankinship, Eric G. Bolen, Bob Bradley, Brian W. Cain, Larry T. Clark, Clarence Cottam, Olan W. Dillon, David Dolton, Don B. Frels, Edward C. Fritz, Ira N. Gabrielson, Mrs. Ira N. Gabrielson, Ann Glazener, W. C. Glazener, Mrs. W. C. Glazener, Peter J. Gogan, Betty Gusey, William F. Gusey, Leland J. Hepworth, Paul Hickie, W. H. Kiel, Jr., Sidney S. Knight, Paul R. Krausman, Wayne R. Marion, Keith Ozmore, John L. Spinks, Jr., A. J. Springs, Thomas Wood.

UTAH

Mayo W. Call, John S. Flannery, Norman V. Hancock, James Kennedy, James R. Kitts, Jessop B. Low, Bud Phelps, Frederic H. Wagner, Michael L. Wolfe, Gar W. Workman.

VERMONT

Joseph W. Artmann, Ben Day, Egbert C. Hadley, Thomas W. Hoekstra, Edward F. Kehoe, Howard A. Merrill, Ronald H. Morgan.

VIRGINIA

Wesley Abler, W. H. Adams, Jeanne Agee, Phil Agee, Shelton H. Alley, Peter A. Anastasi, Carl W. Anderson, Ronald M. Anglin, Dan Appel, Keith A. Argon, Yates M. Barber, Jr., Mrs. Henry A. Baumann, Brian Bedford, Shirley Bell, Paul F. Berg, Mary Neale Berkaw, Robert Berner, Jack H. Berryman, Kenneth E. Black, George Brakhage, Jeannette Brinch, Ester Burghardt, Richard L. Bury, Max Carpenter, Richard G. Childs, Edward P. Cliff, Robert J. Coe, Erminie Compton, Lawrence V. Compton, William M. Conlin, Walter H. Corson, Claude C. Crawford, H. S. Crawford, Earl R. Cunningham, Andy P. Damalas, Gail R. Danker, Steve DiAngelo, Everett R. Doman, Mrs. Everett R. Doman, Patricia E. Downing, Robert L. Downing, Glenn R. Duddesar, R. Franklin Dugan, Larry A. Dunkerson, W. W. Dykstra, Edgar L. Ferguson, William D. Fitzwater, Reynolds G. Florance, Cynthia T. French, Michael Frome, John D. Gavitt, Robert H. Giles, Jr., James E. Gilley, John S. Gottschalk, John W. Grandy, Margaret W. Grandy, William G. Grieve, Jr., Brenda Gross, Eileen Halse, Curt G. Hammit, David Hardy, Richard F. Harlow, Mrs. R. F. Harlow, Reynolds T. Harnsberger, C. B. Harris, Forrest R. Hauck, Bob Hines, Gerald Horner, John F. Hosner, Raymond C. Hubley, Jr., Howard S. Huenucke, John W. Humke, Lynn Hutchens, Harry A. Jacobson, Judy Jacobson, Robert Jenkins, Raymond E. Johnson, Mrs. R. E. Johnson, John H. Jones, Jr., Robert L. Judd, Joe Kathrein, Leah Kean, Warren B. King, Roy L. Kirkpatrick, Ellis W. Klett, Richard J. Kramer, John Krutilla, George M. Kyle, Robert J. Lahm, Victor W. Lambou, Jim Lankford, C. H. Lawrence, Roxie Laybourne, Joe Lint, Jack Lorenz, Charles M. Loveless, Mrs. Charles M. Loveless, Danny Loveless, T. Peter Lowe, Anne C. McBroom, James T. McBroom, Ed Mahalick, Brian G. Marcks, Betty Marshall, David B. Marshall, Dennis Martin, Bill Massmann, John Mattoon, Dominick Mellace, Marilyn Mohyaldeen, Mohammed A. Mohyaldeen, Jerry A. Moore, Karen Morris, Ruth Mrozek, William Murphy, Jr., Michael Nadel, Jeff Nathan, Brad Northrup, John K. Novak, Ben O. Osborn, Mrs. Ben Osborn, Susan Overholt, Ted Pankowski, J. W. Penfold, Mrs. J. W. Penfold, Mike Penfold, Mrs. Mike Penfold, Dick Pennington, Chester Phelps, Mrs. Chester Phelps, Charles E. Randall, Edward T. Reed, Ruth Rehfus, David F. Riley, Francis B. Roche, Peter Rose, Lillien Rothery, Gene Ruhr, Wayne Russ, James Salinas, William J. Sallee, Tom Sanders, Francis N. Satterlee, Patricia F. Scanlon, Ben Schley, E. A. Seaman, William Shake, Mike Slimak, Charles Smart, Bob Smith, Jack L. Smith, Jerome S. Smithe, Carol M. Spurgat, Henry Stebbins, Jerry L. Stegman, Betty Stough, Donald B. Strough, Don Strode, Dorothy Strong, Sheldon Strong, Alfred D. Sullivan, Paul R. Swanson, Lloyd W. Swift, Mrs. Lloyd W. Swift, Lee M. Talbot, Marty Talbot, David Tackle, Mrs. David Tackle, Emmett Thompson, John H. Thorsnes, Nathan Tink, Joe Townsend, Stanley C. Tracey, Thurman H. Trosper, A. H. Underhill, Gerald A. Verstraete, Gary S. Waggoner, Leroy Wiesner, Michael G. Willingham, Everett M. Woodman, Charles F. Zirzow, Loretta B. Zirzow.

WASHINGTON

Ronald N. Andrews, John Biggs, Art Coffin, Carl N. Crouse, John C. Hendee, George W. Hess, Burton Lauckhart, Charlotte Lauckhart, David A. Manuwal, Howard E. Nelson, Mrs. Howard Nelson, Agnes Pettie, Robert G. Pettie, Dale R. Potter, Garrett A. Smathers, Patricia L. Taber, Richard D. Taber.

WEST VIRGINIA

George Arnold, W. Rodney Clay, Craig R. Ferris, Ellen J. Goetz, William Healy, David J. Ozmina, Kathleen Purkett, Joseph C. Rieffenberger, Mary Moore Rieffenberger, James M. Ruckel, David Samuel, Reed Sanderson, Arnold F. Schulz, Robert L. Smith, Ben W. Twight, Norman R. Williams.

WISCONSIN

F. M. Baumgartner, C. D. Besadny, Timothy T.Eisele, Linda L. Eisele, Larry Gillette, Peter Helland, Joseph J. Hickey, Harold C. Jordahl, Jr., John M. Keener, Louise Keener, Robert A. McCabe, Ronald H. Nicklaus, Stephen R. Peterson, Robert E. Radtke, Ronald Sauey, Clay Schoenfeld, Walter E. Scott, Stephen C. Smith, Daniel O. Traimer, Dave Van Wormer, L. P. Voigt, Norman Weeden.

WYOMING

H. Bruce Marker, A. Lorin Ward, Rex S. Zobell.

PUERTO RICO

Thomas E. Morse.

VIRGIN ISLANDS

William Rainey, Edward L. Towle.

AFRICA

Norman Myers.

CANADA

George Alliston, George Arsenault, Ross Baroni, Denis A. Benson, Andre Bouchard, Hugh Boyd, Diane Capel, Richard E. Capel, Jess Carrick, Mary Carrick, W. H. Carrick, Brian C. Carter, Pauline M. Carter, P. B. Dean, T. G. Dilworth, Ken Doan, Darrell Eagles, Eric Grace, James G. Inder, Ken K. Irizawa, Michael Jansson, Don Johnston, Charlotte L. Jones, Robert E. Jones, W. G. Leitch, Hoyes Lloyd, Robert D. Lockwood, Robert J. Long, A. G. Loughrey, Gaston Moisan, Elmer E. Mowbray, Jr., Tom H. Northcott, Jack O'Deffe, Richard C. Passmore, D. H. Pimlott, D. P. Richards, Goeffrey A. J. Scott, Jonathan P. Sector, Lou Sileo, Don W. Simkin, Victor E. F. Solman, Mrs. V. E. F. Solman, Carolyn S. Sugden, Lawson G. Sugden, John E. Tener, Leslin M. Tuck, Bruce S. Wright.

GUAM

Larry Gomoll, Merrilee Gomoll.

MEXICO

Enrique Beltran, Trini G. Beltran, George A. Binney, Ambrosio Gonzalez-Cortes.

SWITZERLAND

Elizabeth Dasmann, Raymond F. Dasmann.

INDEX

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

R

S

T

U

V

W