

**TRANSACTIONS**  
**of the**  
**THIRTY-FIRST**  
**NORTH AMERICAN WILDLIFE AND**  
**NATURAL RESOURCES CONFERENCE**

**Conference Theme:**  
**RENEWING OUR RESOURCES ENVIRONMENT**

**MARCH 14, 15, 16, 1966**

**Hilton Hotel**  
**Pittsburgh, Pa.**

**Edited by James B. Trefethen**

**Published by the**  
**WILDLIFE MANAGEMENT INSTITUTE**  
**WIRE BUILDING**  
**WASHINGTON, D. C. 20005**  
**1966**

Additional copies may be procured from  
WILDLIFE MANAGEMENT INSTITUTE  
Wire Building, Washington, D. C. 20005  
for \$4.50 Postpaid

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MONUMENTAL PRINTING CO.

Baltimore, Md.

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The Wildlife Management Institute wishes to express its appreciation to The Wildlife Society and to the many organizations and individuals who contributed to the success of the 31st North American Wildlife and Natural Resources Conference.

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PART I  
OPENING GENERAL SESSION

# GENERAL SESSION

Monday Morning—March 14

*Chairman:* RUSSELL E. TRAIN

President, The Conservation Foundation, Washington, D. C.

*Vice-Chairman:* RALPH A. MACMULLAN

Director, Michigan Department of Conservation, Lansing

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## CLEANSING AIR, WATER, AND COUNTRYSIDE

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### FORMAL OPENING—THIRTY-FIRST CONFERENCE

C. R. GUTERMUTH

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

It is a privilege and a pleasure to open the 31st North American Wildlife and Natural Resources Conference in this great industrial city of Pittsburgh. Largely because of its relative nearness to Washington, where the Conference customarily convenes every fourth year, this is the first of these meetings to be held in Pennsylvania, even though the Keystone State has been one of the recognized leaders in conservation since the early days of the century.

I see a lot of familiar faces in the audience, but many of you are attending your first Conference. For your benefit, it is necessary to explain the purpose and function of these meetings before turning the program over to the chairman of this morning's session.

All of the programs of these yearly conferences are developed by a large committee representing many conservation agencies and organizations, public and private, from the United States, Canada, and Mexico. The technical session program is formulated under the direction of The Wildlife Society. The Institute provides all of the necessary facilities and conducts the meetings.

As a conference and not a membership convention, the North American Wildlife and Natural Resources Conference is a forum that affords an opportunity for those attending to learn, to confer, and to

discuss subjects of mutual concern. It does not, and cannot take action or pass resolutions. In the audience around you are representatives of many private organizations with often divergent views. There also are numerous officials of international, federal, state, provincial, and regional and local agencies whose responsibilities vary greatly. Most of them are not in a position to commit their organizations or agencies to any position that might be acted upon in a meeting of this kind. Because of this, no resolutions or motions can be entertained. The chairmen of the various sessions have been requested to rule out of order any resolutions offered from the floor.

The Institute hopes that the papers that will be presented and the issues that will be discussed here in the next three days will be the subject of much future action. But any action that is taken must be made by the respective agencies, organizations and societies that are represented in the attendance. The sole purpose of this conference is to provide a clearing house for new ideas and to suggest new approaches toward meeting pressing conservation problems, in the United States and in our sister nations to the north and south.

Discussion periods have been provided after the formal presentation of each paper. We urge all of you to take advantage of this time to comment or to question. All that we ask is that the remarks or questions be germane to the subject of the speaker. All discussion is being recorded and will be printed in the Transactions.

The Program Committee has developed an outstanding agenda covering a broad range of subjects that will be discussed by a distinguished panel of experts. We sincerely hope that the Conference will give a fresh outlook and suggest new solutions to the conservation problems that we all face.

Rather than break into the meeting later, I should like to make a few brief announcements. It is important that all of you purchase your banquet tickets as soon as possible. In addition to an outstanding variety show, we shall have a special ceremony for the first-day-of-issue of a stamp commemorating the 50th anniversary of the Migratory Bird Treaty. If you wish to obtain choice seats, purchase your tickets as early as possible.

Ladies who wish to attend the Ladies' Luncheon must pick up their guest tickets at the registration desk before 10:00 a.m. The luncheon is at noon today, and it is necessary for us to give the hotel a guarantee.

The dinner of The Wildlife Society is tonight. Those of you who plan to attend should buy your tickets at the Society desk before noon.

Thank you for your courtesy. Now, then, it is a privilege and a pleasure to turn the meeting over to the chairman of this opening general session, the distinguished president of the Conservation Foundation, my good friend, the Honorable Russell E. Train. Judge Train.

## REMARKS OF THE CHAIRMAN

RUSSELL E. TRAIN

When I first got into this conservation business several years ago, then something of a hobby rather than as a job, Pink Gutermuth was about the first person I went to and he gave me a lot of good advice.

I would first like to make one or two announcements with respect to this panel.

The Vice Chairman, Ralph A. MacMullan, Director of the Michigan Department of Conservation, Lansing, is unable to be present.

Secondly, Mr. Fisher, who is listed on the program, cannot be with us, but his statement is going to be presented to you.

Primarily I would like, at this time, and I know I speak for all of you, to express our tremendous appreciation to the Wildlife Management Institute for staging this excellent conference and making it possible for all of us to be here, to profit by these discussions and to get together with old friends who have come, not only from all over the United States, but from all over the world. I know that I met a couple of old friends this morning at breakfast who came here from Rome.

And so, to Doctor Gabrielson, and to you, Pink, to Dan Poole and to Jim Trefethen and their staffs, I know that I again speak for you in expressing our great appreciation and deep gratitude for this wonderful opportunity for all of us.

In looking over the program and in trying to see what time our speakers had, I did some rapid calculating. I saw that air pollution got 30 minutes, water pollution got 40 minutes, and natural beauty only received 20 minutes. I asked Pink this morning whether this represented a set of priorities of the Wildlife Management Institute and whether they are against natural beauty and in favor of pollution. He indicated that this was a mistake. Insofar as I am concerned, we shall shoot for roughly a half hour in connection with each speaker, if he wants to use it, and I think that this will work out fine.

Our first speaker this morning, on the subject of "Air Pollution—An Air of Difference" is a professor of Sanitary Engineering and Air Pollution and has been so since 1963. He was trained in Mechanical Engineering at Wayne State University and the University of Mich-

igan. He served with the San Francisco Bay Area Air Pollution Control District from 1956 to 1963 and was formerly with the Air Pollution Control Agency of the City of Detroit.

He is a charter member of the Air Pollution Committee of the National Association of Counties. I am happy to present to you now Professor Benjamin Linsky, Department of Civil Engineering, West Virginia University.

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## AIR POLLUTION—AN AIR OF DIFFERENCE

BENJAMIN LINSKY

*Professor of Sanitary Engineering (Air Pollution), West Virginia University, Morgantown*

Less than 10 years ago, I dropped in on a national annual conference of the National Association of Counties in Portland, Oregon, while returning from a vacation in the Coeur d'Alene region (I directed a 6-county regional air pollution control agency in the San Francisco Bay area at that time). The only session listed that looked as though it might be of air pollution interest was a *Natural Resources* Committee meeting of county and parish supervisors, commissioners, judges, etc. I knocked on the door, walked in, and was welcomed by a California county supervisor who said: "Well, Ben! It didn't occur to us that air was a natural resource—we discuss woods, water, and grazing lands mostly. But I guess air is a natural resource. How about sitting down and telling us about air pollution?"

I said: "Sure—I'll be happy to. Do you want the 5-minute, the 45-minute, the 5-hour, or the 5-day discussion?" He said he thought about 15 minutes was what they could spare. After a fast pitch, lasting 15 minutes, which consisted primarily of my outline of proposed uniform concepts and phrases, with some side comments about forest slash burning, tepee sawdust incinerators, cattle range brush burning, and paper mill odorous gases, as well as Sudbury, Ducktown, and Shasta, they kept me for another 45 minutes, asking questions about what they *really* wanted to know, not what I *thought* they wanted to hear! Incidentally, it was a year or so later that the National Association of Counties established a committee on air pollution which has been and is a significant political force in shaping federal and other national air pollution control policies, legislation, and programs, as well as in self-education and development of countywide air pollution control programs.

Here we are in a situation where I will speak for about 45 minutes about what I *think* you want to know, and you will have 15 minutes to ask about what you *really* want to know, that I have not covered.

Why are wildlife conservation program specialists and land and water conservation program specialists concerned with air pollution? It is my best estimate that most of them are not much concerned yet, except as citizens when they get caught in an industrial plume or in a large city or near a burning dump or behind a stinky diesel or in a lovely sunny vacationland that is attracting executives who start up production plants. That last one—the lovely sunny vacationland that attracts production executives—begins to come a little closer to the conservation program specialist. Whether he is a professional or an enthusiastic amateur, he can see the air pollution troubles in Boulder, Phoenix, Monterrey Bay—or even, years ago, they tell me, the former vacationlands named Pittsburgh, Detroit, Cleveland, and Port Huron, Michigan.

Before going fully into your specialist interest, let us try to agree on some phrases and concepts about air pollutants. This is outlined in a repeatedly refined sheet entitled "Is Clean Air Good Business and Better Health" (Fig. 1).

If we take, as an example, a forest valley with a heavy blue haze, we will often find a traditional type of waste-wood burner at a sawmill. It emits microscopic dusts and droplets. They scatter light and interfere with visibility, directly or by extending the duration of a natural fog. Methods that are not financially ruinous are well known for handling sawmill wastes without emitting these microscopic dusts and droplets, without emitting the larger wood ash particles that land on cars and houses or picnic tables nearby, and also without emitting reactive hydrocarbons that can become sunburned to produce a different type of haze-making microscopic droplets and eye-irritating gases. As I mentioned, practical engineering methods for abating these air pollutants are available. Some of them cost a little money.

Let us look at a Kraft pulp paper mill's air pollutants. Practical abatement methods are not yet good enough to bring the malodorous gas concentrations down below thresholds at the plant gate. A few years ago, the best achievable was a malodor threshold at 15 miles from the plant. Now it is down to about 5 miles during adverse weather—a light drifting breeze.

I suggest that a different approach is needed to handle such a situation—where large and small engineering development work is needed. Instead of waiting for the paper mill owners, the equipment makers, and the private, semi-public, university, and government research people to do piece-by-piece engineering research and development work, I suggest that the United States Government build or buy a full-sized pulp mill and operate it as a research facility. Any paper

"IS CLEAN AIR GOOD BUSINESS AND BETTER HEALTH"  
 Concepts and Phrases Used in Considering Air Pollution

Benjamin Linsky, P.E.  
 Professor of Sanitary Engineering  
 (Air Pollution)  
 Department of Civil Engineering  
 West Virginia University  
 Morgantown, West Virginia

SMOG

AIR POLLUTION

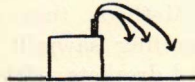
Undesirable Effects:

On people,  
 On the things that people own, and  
 On the things that people like to do.

1. Annoyance to senses
2. Soiling
3. Interference with visibility
4. Sky darkening
5. Damage to vegetation
6. Damage to other property
7. Interference with production or services
8. Impairment of health

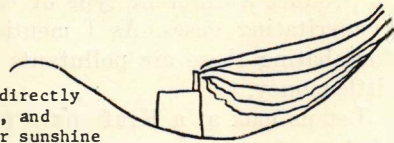
Types of Pollutants:Local

Large Dust  
 Droplets



Area Wide  
 and  
Local

Very small dusts  
 Very small droplets  
 Gases  
 Primary polluting gases, directly  
 Secondary polluting gases, and  
 Double-acting gases, after sunshine  
 or in fog



Single Sources: Nearby small source; farther large source

Figure 1.

pulp they produce could be sold on the market—assuming that the Government would not choose to make paper, too, for its own many uses. Interruptions to pulp production could then be justified as part of essential air pollution control engineering method development costs. The findings could then be given freely to the paper industries of the United States, because they would be for the public's benefit.

Multiple Sources:

Coal and heavy oil burning  
 Rubbish burning - industrial - commercial - multiple dwelling  
 Industrial processes  
 Residential rubbish burning  
 Motor vehicle exhausts  
 Etc.

The Weather and the Hills:

Don't create the pollutants  
 Sometimes hold man-made pollutants in an area:  
 Sunny days,  
 Foggy days and nights,  
 Other

Practical Controllability: - without economic ruin, for

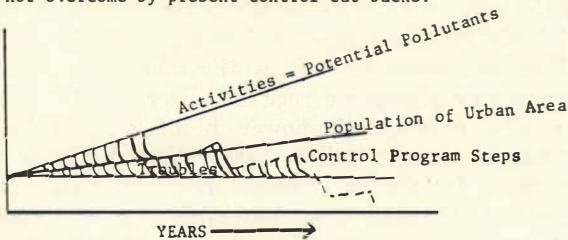
Almost all types of pollutants, now  
 Almost all types of sources,  
 The few remaining are now subjects of enough or too little engineering research and development.

Application of Practical Controls: - when

People learn they have been applied elsewhere.  
 People decide they want cleaner air--and insist on it, vigorously, with legislation resulting.

Growing Need for Technical and Legal Controls:

Growth not overcome by present control cut-backs.



More automated and precision industries want cleaner air for their new plants and new employees' homes.

Need for Presenting Specialized Technical Information in Non-Technical Language:

More existing information is needed by non-specialists in air pollution.

Revised, 1956  
 Revised, 1957  
 Revised, 1963  
 Revised, 1964

Figure 1.

Recently there has been discussion of charging a regular, legal fee to owners who choose to pollute the air rather than clean it up. (I saw one open channel where this practice was being followed for water pollution. The ugly, black, oily appearance and the occa-



sional bubbles of gas, when added to the periodic malodorous gas emissions that were released from some of the liquids, provided an unpleasant neighborhood factor.) If a "legal fee to pollute" were established for air pollutants, the consumer would pay the fee in the price of the product or service. In addition, he would be paying the economic and social-psychological costs of the effects of the air pollutants. The present social stigma of fines and jail sentences, plus summary abatement actions, sealing of equipment, and court injunctions would be deleted as incentives for control and prevention of air pollutants emissions.

The relatively minor cost of control, as a percentage of the final cost of the product or service, is rarely displayed in the consumer's customary terms. The chart of cost elements of electricity in a mid-western city was developed from a report by one of my graduate students, Anthony J. Tarquinio. It has been validated by senior executives of two major utility companies. With this chart in front of you, you can estimate the final impact of some extra cleaning of ash and sulfur from coal prior to its use in meaningful terms. It is, of course, necessary to avoid being awed by large total dollar figures such as for annual costs in a large city, or capital costs of control equipment (Fig. 2).

The potential impact of mine-mouth power plants, if not suitably provided with air pollutant control factors, could be considerable—though perhaps not quite as bad as the man-made deserts around some ore smelters or phosphate rock fertilizer plants. It is amazing to see some new mine-mouth power plant designs that use the crowded bottom of a river valley, rather than plateaus that would permit more space for future chemical recovery plants for cleaning stack gases, with taller chimneys. The added capital costs and operating costs for moving coal up from a dock or a railroad, and for pumping cooling water up from a river are, of course, detectable. But the resulting freedom for dealing with anticipated air pollution control needs were not given enough weight, it seems to me.

I could devote a good deal of time in describing episodes and situations where management lethargy, in a comfortably profitable market, permitted obsolete equipment and methods to pollute the air when a change would have provided clean air plus significant profits. Only the social stigma factor led to the changes, when a change would have provided clean air plus significant profits. Only the social stigma factor led to the changes, when they were finally made. As you know, much of our production equipment is more than 25 years old.

You will also be interested to learn that there are a number of in-

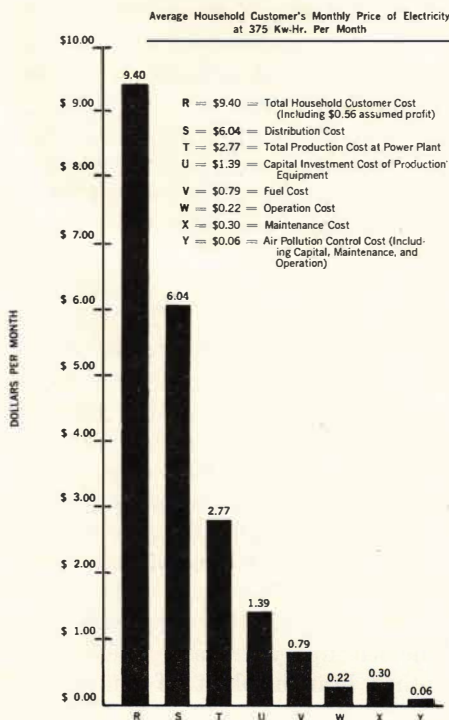


Figure 2.

stances where a key management figure says “clean it up” and “put it in clean” without any incentive other than his own self-concept as a man with social responsibility, with support by his fiscal management.

However, the best long-range or short-range self-interest of a management may lie in deferring installations. Every year of delay in a \$1,000,000 non-profitable installation may save \$250,000 a year. A small part of this will buy a lot of time in studies, lobbying, etc.

If you have gained an impression that air pollution problems and troubles are recent, and that air pollution control engineering, science, and technology are new, you have been misled. Air pollution control engineering was developed in 1863 when the British enacted the Alkali Act to control some chemical industries that had been messing up the countryside for many years—the fields and forests.

In 1906 the air pollution control specialists in North America organized what is now the Air Pollution Control Association—at a meeting in Detroit. The first President was Detroit's air pollution

control agency chief, and one of the other officers was a Canadian. Fifty-one years later, I was Detroit's air pollution control agency chief and the 50th President of APCA, whose headquarters are now here, in Pittsburgh, at Mellon Institute.

I brought along two air pollution reports of the pre-1915 years—one massive study of Chicago and the other of San Francisco air pollution. By that time almost all of the present basic air pollution control engineering tools had been developed, as well as the social-political techniques.

They even had a mobile air pollution measurement laboratory in the then-version of a station wagon. They also used punched cards, but with round holes, for data reduction—the Hollerith system.

The San Francisco report refers, among other troubles, to the Shasta Smelter and the related massive effectives on vegetation.

What, then, is new? Why the push and pressure for cleaner air?

I think the answers lie within the following:

*First:* More people have been learning more quickly that they could have had cleaner air right along without economic disaster, ever since the 1912 electrostatic precipitators were installed on the cement kilns at Riverside, California. People feel cheated, and angry, when they learn that air polluting processes like the ones bothering them were cleaned up, years and decades earlier, elsewhere—sometimes in another branch plant of the same parent company.

*Second:* In a few places, the rapid growth of activities at home, at work, at play (wasn't there once a burning dump at Yosemite?), and to-and-from, produced a deterioration in the quality of the air so fast they could remember it and get angry about it. Los Angeles, San Francisco, and Boulder are examples.

*Third:* There is increasing apprehension about health impairment, especially about the aggravation of existing illnesses and weaknesses such as allergic asthma.

*Fourth:* As more people travel more widely more often, they are shocked by some of the suddenly bared hillsides near large processors, by the hazes and stenches of other operations in cities and even in the woods and parks, and by the griminess of their own neighborhoods when they return home.

*Fifth:* More public leaders in Federal, State, and local governments find that they really have public support so that they can afford to be statesmen, even though it costs them some industrial "brownie points." In addition, state and local public leaders know that some of the very desirable employers will not move into a polluted air.

What more do you need to clear the air so your cities, city parks, fields, forests, and waters are enjoyable?

I could speak at length of the need for full-scale proved systems for control of sulfur oxides from coal and heavy oil burning. I could speak of the need for systems for control of oxides of nitrogen from all types of burning. I could speak of the need for better, more reliable measuring instruments for detecting the parts per million and parts per billion dilutions in air that are troublesome. (Imagine picking out one automobile from all of the automobiles in a city like New York!) I could also speak of the needs for establishing air quality criteria of concentrations, durations, and undesirable effects. But I would mislead you—conservationists—if I spoke extensively of the things we still have to learn to do.

Let us instead look at the tools that are available to “farm as well as we know how, now.”

I mentioned electrostatic precipitators. I can also refer to cyclones, cloth filter collectors, scrubbers, afterburners, and chemical reactors. I can even point, with great caution, to the “shipmaster” form of releasing more pollutants during brisk weather, and from tall stacks. In addition to these tail-end-Charlie types of control, and even more important, I can point to changes in operating equipment and raw materials which obviate or minimize the need for tail-end collectors.

We can also discuss the systems approach and operational research for optimizing government agency control activities to provide the best regulations, construction permit leverage, and operating certificate device to assure conformance with requirements.

We can also discuss the growing use of modern technical information libraries such as the one we developed in the San Francisco Bay Air Pollution Control District, with copies now available at several public agencies and a few universities, starting with West Virginia University.

Much has been said recently about the use of systems analyses in establishing air pollutant controls that are compatible with water pollution prevention and land conservation. We are, I believe, on the threshold of testing and establishing schemes that will turn more of our city solid wastes, farm solid wastes, forest products solid wastes, and mineral processing solid wastes into reusable materials by using improved transportation systems. These can include loads for the return trips of coal unit trains that could carry fly ash and pulped city refuse to used strip mines and other places that could use the materials. The threat of long pipelines developed improved, cheaper coal haulage. It might work again for other materials that,

otherwise, would add air pollutants as they were processed differently, such as by city incineration.

Most of you have probably heard that the Federal Government is now providing matching grants to cities, counties, regional agencies, and states who initiate or augment air pollution control programs. You also know about the various grants to support planning efforts. These are being combined in some places, like Chicago, to try to develop optimal action programs. Preventive and corrective programs for air pollution control ought to be established in more of our lovely recreational areas, where one new processing plant without adequate air pollution safeguards can spoil things. It was less than four years ago that the determined action of only one family of ranchers made a utility generating plant come in much cleaner than they had intended—less than 25 miles from a famous Colorado vacation area. There is an obvious, but rarely met, need for formal control programs before an area is developed industrially—something better than “keep all industries and solid waste disposal facilities out of our town or county.”

We also need to use some citizen support. This is usually now only available when one angry individual decides to invest his own time and effort without monetary or political reward. He puts together an “umbrella organization,” which is usually temporary and lasts only until the local trouble is cleared up. His (or frequently, her) willingness to stand up and be a target for those who wish to delay action always draws quiet support from citizens who are economically vulnerable in their own jobs or through the work of relatives. The continuing organized support of organizations that have a primary interest in the enjoyment of natural environments might amplify the occasional individual or small citizen group effort. Without this citizen support, a vigorous air pollution control agency chief becomes used up, in time, because of the resistance and defensive aggression of owners who choose to buy clean-air deferments—I call them Smog-gards.

As I bring my prepared presentation to a close, you have seen that I left you with broad targets. I also left you with general steps that can and have been taken in some places in combatting some types of air pollution. This attack approach seems to be more effective in obtaining continued support activity than holding up desirable goals, as many of you know. Your own personal reaction to “You can’t see the hills 10 miles away, even though there is only 30% relative humidity” may be more meaningful than “I wish I could see the hills 10 miles from here on a dry day like I used to.”

We have one additional step which needs to be taken, by the way.

There are not enough men trained as specialists to meet the growing demand for them. The graduate training programs, like ours at West Virginia University, even with well priced fellowships and stipend support, are not turning out men fast enough. We even have to scramble to get good graduate students. Our graduate training program, like most of the others, is financed largely by the Division of Air Pollution, Bureau of State Services, Public Health Service, United States Department of Health, Education, and Welfare. We need more trained men for the field. They need real breadth to cover the many disciplines that are involved in the subject area of air pollution control. As a Professor, you will (I hope) excuse me for pointing this out at the point of greatest emphasis—the end of my paper.

#### DISCUSSION

CHAIRMAN TRAIN: Thank you, Professor. Are there any questions?

MR. ROBERT DENNIS (Izaak Walton League of America): We are one of the groups assembled here, and the Izaak Walton League has taken an interest in this problem. I would like to make just a couple of comments.

First of all, it seems to us that, even though there has been federal legislation in this field, most of the effort to control air pollution has been based on community action and on what seems to us to be a rather limited geographic approach to a problem that really seems to be nationwide. I think that some of this crept into your talk when you said that if these folks are going to burn, then let's do it where there is a good enough wind so that it blows the pollution away. However, the question is where does the wind blow it? It may be to the next town or state to the southeast, especially if it is a good northwest wind.

We have sort of been under the opinion that a number of things ought to be done, and one of these would be to try to encourage the Weather Bureau to start describing certain atmospheric conditions in terms of air pollution, which seems to be a commonly used term these days. Perhaps if we could get television people talking about the fact that air pollution is messing up the sky, then, in turn, we might get better public recognition of this as a national problem.

The second point, which we believe has some merit, is the suggestion by the President's Science Advisory Committee that we put a tonnage fine on wastes, and this could be applied on a uniform nationwide basis. This becomes an additional production cost and thus, in turn, companies, in consideration of their stockholders, are going to try to cut down on pollution.

I wonder if you would care to comment on those possibilities.

PROFESSOR LINSKY: Let me take the first one quickly and then pass on to the second one, which is far more important to me.

Using a definite term to describe an atmospheric condition, certainly one that is closer to being meaningful in terms of the people who are involved, would be helpful; and so a term of air pollution or visible air pollution, rather than haze, would be helpful.

Now, with respect to the proposals for taxes or fees or licenses to pollute—if you will look at the bar chart that was furnished you, you will find that we are talking about a cost of six cents out of \$9.40 or thereabouts per month for a household bill. You could double that and even triple it, and it still would hardly show on the meter bill.

If instead of putting the money into air-pollution control equipment and methods, the same corporation puts money into a fine, rather than make all of the cumbersome changes in connection with a modified plan and its operation, the added cost of the fine, or fee, which would now be legal, would go on to the price of the product. So you would be paying for not having air pollution con-

trolled in your product. You would yourself be paying the fee as a customer, while, in addition, you were still enduring all of the degradation of the air pollution.

I have seen one attempt at this in connection with water pollution in an open river. It stunk, was dirty, was black-looking and quite unattractive for a fair distance on either side of this particular location. Yet the companies were paying a regular legal fee to pollute.

What is the real problem here? The real problem is that you lose the element of social stigma when you make it legal to pollute.

In addition to adding the cost of that fine or fee to the product that the receiver of the air pollution has to buy, you have the legal problem and administration. So, as a result, it becomes a double penalty and one with no gain.

This proposal has been made seriously by economists who I don't think have looked at the realities of social political life. When a man has to sit in jail for from two to four days because he repeatedly violated air pollution law, then word gets around fast and not very many more people have to sit in jail in that community for several years.

This has been the experience relative to vigorous air pollution control problems. Have I answered your question?

MR. DENNIS: It does seem to me that part of this has to do with the level of what I call license to pollute. There are different ways of looking at this.

PROFESSOR LINSKY: I have seen too many operations where management was in a profitable business and whereby obtaining new equipment and changing their methods of operation they could not only have cleaned the air, but also made a very prudent profit. Yet they chose not to do so because this simply was more trouble, used more energy, and it took more out of some of the people directly involved—the plant engineering and management people. In other words, they would have to retrain supervision and operators and, of course, they were presently doing all right on their present profit basis anyway. I have seen too many of these instances to know that they fail to appreciate the moral stigma—that the social stigma is far more important than the dollar right away.

MR. GERALD SCHNEIDER (National Office, Girl Scouts of America): The question that I am going to ask relates generally to what citizens in general can do about air pollution and what directly we can recommend to young people in our nation who belong to organizations such as the Girl Scouts and cannot get involved in any political action.

Are there any devices to control incineration pollutants available and economical enough to be used by property and building owners and small homeowners who may have their own incinerators? If so, what is the source of these devices and, if not, what of the future of this type of air pollution control?

PROFESSOR LINSKY: Insofar as the homeowner burning that part of the total solid waste that is combustible, in my opinion, there are no adequate devices.

With respect to apartment houses, unfortunately, the few incinerators that can do a job and are currently operating, are not operated by careful operators. After all, you do not have graduate engineers running apartment house incinerators. So, facing the realistic facts of life, I think that the place of the apartment house incinerator is away from the do-it-yourself incineration. I can also tell you that one very large apartment house project developer, who are reputed to be very good with cost-accounting methods, The Metropolitan Life Insurance Company, learned that they could have material hauled away cheaper than even using their old-fashioned incinerators that they were going to have to discontinue using anyway. They found that it was cheaper to have the material hauled away than to have the firemen use the incinerators.

At the same time, by so doing, they likewise did away with the complaints from the people on the top floors who could not leave their windows open because of the black soot and other materials that would fly into the windows. Therefore, my best guess is that the apartment-house incinerator is dying out.

MR. NICHOL: (Asst. Attorney General, Lansing): In Michigan we have real

estate tax immunity for air pollution equipment that just went into effect. Have you found that to be helpful in inducing industry to put in air pollution equipment as well as the possibility of accelerated amortization of the cost of the air pollution equipment?

PROFESSOR LINSKY: I strongly endorse the tax relief for this kind of equipment, partly because it reduces the pain on the part of the owners who have to install the equipment and also because it is an expression of the body politic that they are serious about it.

It also does one other thing—it removes the kind of argument, "Gentlemen, you don't even care enough to give us tax relief for something we are only doing for your own good." Therefore, it is for this reason that I would endorse these relief measures.

MR. DANA ABELL (Concord College, W. Va.): Every once in a while I make arrangements to meet someone from Morgantown up in Charleston, and the trip there is beautiful until we get into the valley. Then we are greeted with all sorts of smoke from Charleston, which has about the worst air pollution of any city in the country. Most of this is done by a public utility burning their material out into the air. Therefore, I am wondering about working on segments of the economy, such as the public utilities, which are operating under a permit from the various public commissions, as a starter. Here is a utility, for example, that sends out publicity in the form of a bill, if you can call that publicity, each month, and has the opportunity to say, "See now, we have cleaned up our problem; let's all get on the bandwagon." Has this approach been tried and what kind of relationship do the air pollution control agencies have with the various utilities?

PROFESSOR LINSKY: They have had a wide variety of relations with them because utilities are generally heavy targets for air pollution control since they are massive symbol sources. After they clean up, they are usually proud to talk about it. Of course, there are some of them that choose to do it voluntarily, and some will do it only when they have to.

I would also like to comment here that there are some kinds of things that the Girl Scouts can do to help here, especially relative to measuring some of this pollution with very simple tools—simple things like a microscope slide smeared with vaseline for microscopic dust. These instruments are in almost every high school laboratory in the country, I think; and, if not, then there is one in some doctor's office, however small the town. Therefore, with these kind of measurements I think that the fight against this could be carried on by some of the youth groups.

MR. ROBERT MORGAN: I cannot document my statement, but recently I read a statement by some responsible person that within a hundred years the chemical changes in the air were such that, at the rate we are going, the higher forms of life would be seriously damaged if not destroyed. Can you comment on this?

PROFESSOR LINSKY: I believe that this was a comment made by a professor at UCLA. There is no blackboard here, but then let me illustrate it like this.

If we have intensity or concentration on a vertical chart scale and time the other way, and if we are at this point now, all of our population, our activities, population and otherwise, are growing. In fact our productive activities and use of materials are growing faster than the population, especially with the increasing standards of living—and this was his point. He asked what would happen when the Chinese and the Africans all got cars? The key point is that if we go along the way we are, that this is quite probable. But then, on the other hand, I think that we have intelligence, and so I will bank on the intelligence of our people and our government.

MR. PAUL WENDLER (Mich.): You mentioned about the problem of exhaust fumes from the automobile and that problem was one of the photo chemical reactions which is prevalent in only certain areas of the country. I believe you mentioned Los Angeles, Detroit and Washington and certain wooded areas.



Do you think that we are justified to adding on to the price to the customer anywhere from 30 to 50 dollars of a new car at this time, especially when this condition apparently only exists in a small percentage of the country?

PROFESSOR LINSKY: I believe that by naming only a few places I may have given you a misimpression. Actually, this is something that occurs in most of the major populated areas of the United States. Of course, most of this problem is caused on weekends, when most people tend to go out and picnic and that sort of thing. When it is quiet and sunny, those are the days when you get stagnation. That is the time when you get pollution going into the air from motor vehicles and other sources, which, in turn, causes these major problems. Therefore, I do not mean to imply that only a small area is involved.

Incidentally I helped draft the California state laws, where the same question came up—Should these devices be required up in Shasta or Lake County?—and the answer was “yes,” they should be required on new cars. I have endorsed and supported federal legislation which says that we need them all over the country.

CHAIRMAN TRAIN: Thank you. Gentlemen, I believe that closes our time for questions. Thank you very much, Professor. The interest and value of your presentation was evidenced by the number of questions asked. The question with regard to fes in connection with those doing the polluting raises the same kind of question, at least in my own mind, that occurred over the years down in the State of Mississippi.

Mississippi is a dry state and has been for many years and yet has a normal excise tax on the sale of legal whiskey. In other words, bootlegging is quite respectable there. (Laughter)

Our next speaker is an attorney. He has his Bachelor of Law degree from George Washington University, and I note with some envy that he was on Law Review, a distinction which I never have personally been able to attain.

From 1955 to the present, he has been a member of the staff of the Federal Water Pollution Control Program.

I might say that I am particularly happy to welcome a fellow lawyer to this conference. I think that there are all too few lawyers in the conservation and resource business. Maybe this is a professional bias on my part, but it seems to me that the law is perhaps the primary social tool in the control and management of the natural resources. I think that we need more lawyers in conservation.

Our next speaker has handled all pollution enforcement cases under the Federal Water Pollution Control Act, and he is, at the present time, Chief Enforcement Officer, Federal Water Pollution Control Administration. He has the high regard of conservationists from all over the country for the job he has been doing.

I am happy to present Mr. Murray Stein who will talk on the subject of water pollution.

**TO RENEW OUR RESOURCES—CLEAN WATER****MURRAY STEIN***Chief Enforcement Officer, Federal Water Pollution Control Administration, Washington, D. C.*

*“ . . . to enhance the quality and value of our water resources and to establish a national policy for the prevention, control, and abatement of water pollution.”*

These are among the first words of the Federal Water Pollution Control Act. Their meaning is so plain, it is hard to conceive that until a few months ago the Act did not begin with that firm declaration of purpose. That the statement is law at last, and that a strong national commitment lies behind it, is in no small part the work of the conservationists of America.

Conservationists were first in the fight for clean water. They stand today in the front rank as the battle mounts.

It might be said that talking to this audience about water pollution is preaching to the already converted. But you are not here for exhortation, nor are you here for praise, as much as you deserve it. You are here to assess the state of the natural resources with which the North American continent was so richly endowed, the destruction which man has wrought on them, and the measures which must be taken for their restoration.

It is an honor and an opportunity to take part in this Thirty-first North American Wildlife and Natural Resources Conference, and to appear on the program with two old friends and distinguished officers of the Wildlife Management Institute, Dr. Gabrielson, Mr. Guter-muth and Mr. Poole. We are here to talk about cleansing air, water, and countryside. As many of you may know, I specialize in clean water.

If this meeting were being held as recently as a very few years ago, we would be talking about that unwitting ally of pollution—public apathy. We would be deploring the back-page treatment in the newspapers of stories about pollution. We would be criticizing the piggy-bank terms in which public officials considered pollution budgets. We would be asking when American industry was going to face its responsibilities. How different the climate is today! The people are demanding clean water. Letters from all over the United States pour into the Federal Water Pollution Control Administration, the earnest letters of schoolchildren, the thoughtful letters of their elders from many walks of life. Some point out specific pollution situations which warrant investigation. Some offer encouragement or suggestions. Some seek information. Many ask, “What can I do?” It is this last, a feeling of personal responsibility, a willingness to get involved in the fight against pollution, that is most significant. When

we write to these good citizens, one of the things we urge them to do is to join one of the voluntary organizations which are so effective in mobilizing action for clean water.

The new awareness is reflected in the press, and, in turn, is given impetus by the press. Pollution has moved from the back page to the front page. Leading newspapers are devoting more and better space to pictures and feature stories about pollution. Editorial support has grown. Increasingly it recognizes the need for drastic action to save the waters of the Nation from destruction.

Years ago elected officials were reluctant to go to the people with a proposal for raising money to build waste treatment facilities. They had no glamour. They believed such projects did not help get them re-elected at the end of their term of office. They preferred to build schools and libraries which were more highly visible and which impressed the people as something they had accomplished.

Today a change is taking place. In 1965 in the State of New York, the Governor sought and the legislature passed without dissent a package of legislation to strengthen water pollution control in New York. A billion-dollar bond issue to finance the nonlocal share of municipal waste treatment works construction—an ambitious program to clean up municipal pollution in six years—was approved by the people of New York last November by an overwhelming vote, a margin of more than four to one. By about the same margin, the City of St. Louis in 1962 successfully passed with voter approval a \$95 million bond referendum for water pollution control facilities, and Kansas City, Missouri, in 1960 got voter approval for a \$75 million revenue bond proposal. I know elected officials are listening. The American people want clean water. They will return to office those who give them clean water.

Industry spokesmen show a new consciousness of the public demand for clean water. A leading oil company put an item about pollution abatement in its January news leaflet. "We believe in and practice the good neighbor policy," it quoted a company official. "We not only meet local air and water pollution control requirements, but strive to exceed them." The item appeared ahead of one about the tiger in your tank. I mention it because it indicates that industry increasingly considers it good public relations to be for pollution control. In Madison Avenue terms, clean water is "believable."

It is progress when conservationists and industrialists can agree that clean water is the goal, even if they continue to define it differently and to advocate different means to attain it. The first Conservation-Industry Conference, held in Washington last December under the sponsorship of the National Wildlife Federation, was evidence of the new communication.

In our Federal enforcement action last August in the matter of the pollution of Lake Erie, eight Cleveland area companies agreed to furnish information on their waste water discharges which had hitherto been withheld. These eight companies included giants in oil, steel, and chemicals. We looked on that as a breakthrough of immediate and possibly future significance. Longstanding pollution problems of the lower end of Lake Michigan and the Calumet River System should be met in a remarkably few years as a result of our agreement reached in Chicago a few weeks ago. Our enforcement activity in that complex case, with the cooperation and assent of industry, fixed a timetable for the control of industrial waste discharges which will involve the construction of extensive facilities and the adherence to water quality criteria which are the strongest ever approved for such a water area.

All of this has taken place in a few years. But it is the fruit of the long labors of Americans deeply concerned that the onslaught of pollution from city and factory, farmland and mine, vessel and bulldozer would defile beyond hope of restoration the rivers and streams, lakes and bays, estuaries and coastal waters which are the people's legacy.

The Water Quality Act of 1965, which added the firm statement of purpose to the Federal Water Pollution Control Act, also created the Federal Water Pollution Control Administration, authorized the establishment of water quality standards for interstate waters, provided for a four-year demonstration program for the development of new and better methods of controlling pollution from storm sewers and combined storm and sanitary sewers, and liberalized the program of grants for the construction of municipal waste treatment works. The enforcement authority was extended to certain cases of serious economic injury to shellfish producers engaged in interstate commerce. The Federal Water Pollution Control Act, which became permanent law in 1956, has been amended in important respects before, in 1961. The Federal Water Pollution Control Administration, armed with its own identity, and with a strengthened law, came into being on December 31, 1965. Except for the extension of expiring authorities, another major water pollution control bill might not have been due for at least several sessions of the Congress, in the ordinary course. But pollution is not taking an ordinary course. It is increasing at a devastating rate. How to stop it has been the subject of intensive deliberations in and out of government this past year. Concrete proposals are before the Congress now. As the knowledge and experience of conservationists have been invaluable in the development of these proposals, they will be invaluable in their consideration.

Witnesses from the conservation organizations spoke almost alone

for strong water pollution control more than thirty years ago. They made an outstanding contribution to the most recent Congressional hearings on water pollution last year.

It is not a coincidence that water pollution, generally regarded not long ago as one aspect of the public health problem, emerged as a critical problem of natural resource management during the Administration of President Johnson. President Johnson has made the preservation of our natural heritage a national goal. He has linked the beauty of America with that enjoyment of the good life which is the essence of a Great Society. He has declared that the poisoning of our waters impairs the quality of life, and has resolved to end it lest we be strangled in the wastes of civilization.

When the President signed the Water Quality Act on October 2, 1965, he was eloquent and he was plain. He said that "no one has a right to use America's rivers and America's waterways that belong to all the people as a sewer. The banks of a river may belong to one man or one industry or one State, but the waters which flow between those banks should belong to all the people." Nothing less than the restoration of the polluted rivers of America from their sources to their mouths is the aim of the President's far-reaching proposals to the Congress. They include a river basin approach to effective water clean up, additional funds, and improved enforcement authorities.

The Federal water pollution control program is especially fortunate in its advocates in the Congress. Representative John Blatnik of Minnesota, the sponsor in the House of the 1956 law, and the major amendments of 1961 and 1965, Representative John Dingell of Michigan, an eloquent and effective spokesman for clean water as for many conservationist causes, and other old friends have been joined in the House of Representatives by a host of Members, some in their first term, who have pledged to their constituents that they will stand up and be counted in the fight against pollution. Senator Edmund Muskie of Maine, as chairman of the Subcommittee on Air and Water Pollution of the Senate Committee on Public Works, gives leadership in that body, and he has introduced legislation in which 47 Senators have joined as cosponsors. The Administration has proposed legislation which will inaugurate a Clean River Demonstration Program, substantial increases in Federal enforcement authority and accelerated research.

To mount the attack on water pollution, the President has proposed to transfer the Federal Water Pollution Control Administration to the Department of the Interior, which has long been concerned with the comprehensive management and development of our water resources. In the absence of the adoption by either House of the Congress

of a resolution of disapproval before that date, the transfer will be effective on April 30, 1966, sixty days from the transmittal to the Congress of Reorganization Plan No. 2. If the Congress assents, we would expect to carry on a vigorous anti-pollution drive as part of the Cabinet Department which is the custodian of the Nation's natural resources.

What are the essentials of success? I would submit that there are three elements involved: technical knowledge to which research continually adds—money—and enforcement. We have enough of all of these to check pollution and reverse the tide right now. Technical know-how is available for resolving most of the pollution problems now. It will be forthcoming for those problems which still require answers. In the matter of money, it is inconceivable that the richest country in the world that has developed the most sophisticated methods of financing would find this an insuperable problem. Such sophisticated methods have developed industries such as steel, automobile, and petroleum to a size never dreamed of before. Who can believe that we will not be able to arrange the required financing for cleaning up our valuable waterways. Where the technical knowledge and the money are both available but reluctance and foot-dragging persist in their application, we have the enforcement authority to see that they are put to work to end pollution.

The Water Quality Act of 1965 created the Federal Water Pollution Control Administration, and, among its other provisions, put the new agency into an untried area of federal regulation—the establishment of water quality standards for interstate waters or portions thereof. Historically, conservationists have had some well-founded misgivings about water quality standards. You have seen the operation of state classification systems where the reach of a river would be consigned to uses no better than navigation and the transport of wastes. You have had the experience that water quality standards applied to a stream would lock in pollution. Some of you will have to be persuaded that water quality standards will in fact serve to enhance the value of water, to protect the public health and welfare, and to preserve waters for public water supplies, fish and wildlife propagation, recreation, agriculture, industry, and other legitimate uses.

What we have to avoid in fouling our waterways is becoming misled by vague and unanalyzed concepts concerning the purpose and use of our water heritage. We have allowed the metaphysics to become the reality. As usual, in such cases, the result has not been entirely felicitous. In any body of water there is an amount of oxygen which will act in the way oxygen always does in our physical world

to stabilize organic wastes deposited in the water. This simple scientific fact is necessarily taken into account by every designer and operator of waste treatment facilities. In order to present an economically attractive proposal to municipalities and industries which often were reluctant to put in these waste treatment facilities, the developers began talking in terms of assimilative capacity of the stream to absorb wastes. They were taking full advantage of this assimilative capacity so as to reduce the apparent cost of the waste treatment facilities. Then it was only one step to the development of the notion that the dischargers of waste had an inherent right to this assimilative capacity. While no one has yet been able to point specifically to a citation giving anyone a constitutional or divine right to use the assimilative capacity of streams, the proposition is put forth with such earnestness and fervor in schools, in textbooks, and at water pollution control meetings that one might think it had such status. I believe that oxygen naturally in the water belongs to fish and their attendant chain of life as Nature intended; that wastes put in the water and utilizing this life-giving element usurp this gift of Nature for private purposes; and that our goal should be maximum treatment of wastes at the source. Some of us, I sincerely hope, may live long enough to see the day when our national purpose will not be to determine how much we can put in but to see how much we can keep out of the stream.

I believe that the establishment of standards will be a most useful tool in cleaning up the Nation's waters. It is recognized that the use of standards can and often has been abused but that does not negate the effectiveness of the tool. If such effectiveness means the constant and eternal vigilance of the conservationists, I know it will be forthcoming.

In dealing with water pollution control problems we do not believe in a semantic clean-up of our waterways. That is, by putting out reports which gather dust on the shelf, by issuing statements replete with glittering platitudes, or by issuing clay-coated paper brochures which allegedly show the amount of progress by the number of plants being built. The measure of pollution control is one that can best be gauged by the people themselves. And this is what use of the water can you make now that you couldn't before. Can you swim now, where you couldn't before? Can game fish live and propagate where they couldn't before? In order to achieve this in present-day America with its divergent pulls of myriad economic and social forces, we have found that we have to develop a detailed and sophisticated list of water quality requirements. For example, in the lower end of Lake Michigan we developed requirements expressed in nu-

merical terms covering some 200 items. One reporter described our efforts as working long and hard and producing a veritable telephone book. In short, we have to develop water quality standards covering a broad spectrum of substances and locations if we are to expect industries and municipalities to invest hundreds of millions of dollars in waste treatment facilities. They have a right to expect us to provide them the certainty that the standards are firm and right. In doing this we must always give precedence to our obligation to the people that the standards are so framed as to protect the maximum number of present and future water uses.

Particularly after the drought in the East and the realization that Lake Erie would die if something was not done and consequently that area's important industrial complex would vanish, much of industry has come to realize that water is an essential basic raw material and industry's interest in preserving water is now like ours and your conservation interest.

The federal authority to fix the standards will be invoked only in the absence of timely satisfactory action by a state to set water quality criteria for the interstate waters within that state. We are receiving from the states the required letters of intent to comply.

The Federal Water Pollution Control Administration has an identity denied the Federal program in its days in the "seventh sub-basement." If the Congress approves the President's budget requests for our activities, we should be equipped to move ahead in the coming fiscal year. Enforcement, the arm of the program for which I have particular responsibility, has an impact, I believe, which goes beyond the purpose of a particular conference. Lake Erie was an object of despair. Our conference sessions at Cleveland and Buffalo have given focus to widespread efforts to save the lake. The Hudson River has been abused for generations. Its majestic beauty, its historical associations, its untapped prospects as a source of pleasure to the millions within easy reach of its shores, were sacrificed to long indifference and to crass economic considerations. Frustrations mounted at the threat to Storm King Mountain. Our enforcement conference offered a forum and a mechanism for the solution of some of the problems which beset the waters of the Hudson.

In every enforcement action we have taken under the Federal law, recreation or fish and wildlife propagation or aesthetic considerations, or some variant or combination of these, has been among the water uses or potential water uses impaired by the pollution. We have a duty to restore polluted water for these and for all other legitimate uses, and to save relatively clean waters from degradation. Here, where the Monongahela and the Allegheny join to form



the Ohio is a good place to reaffirm our resolve. This conference is a fitting occasion. The time is now.

## DISCUSSION

MR. ROLAND CLEMENT: (National Audubon Society): I am impressed with the political significance of the economic interpretations the last two speakers have made, and I would like their endorsement of my own interpretation by restating this in a very simple sentence. I would simply want to be sure that Mr. Stein could join Professor Linsky in endorsing this statement—that we can have almost any pollution cleanup that we want without undue economic burdens on any one. Would you agree to that?

MR. STEIN: I have only seen one case where there might be an argument that this could not be achieved. We have dealt, in our particular program, with some 1200 industries in some 1200 cities. However, I must tell you that we have had failures as well as successes.

One of these involved a soda plant located on a small stream producing raw material. It was built on this location in 1890, where, in reality, a plant never should have been located. It creates a load of salt which goes into the water and makes that particular stream unsuitable for many uses. The difficulty is that a plant that employs 300 people and is in the heart of Appalachia presents a problem; for, if we close that plant, we will affect that area economically. We have not yet been able to come up with a solution. However, I would say that, by and large, what you say is true.

PROFESSOR LINSKY: I can also endorse your statement, with some minor reservations. However, there will be occasional single plants where you will continue to have violations no matter what you do. I do have a few cases where air pollution control was a factor in shut-down and removal, but that is all I know of. Therefore, other than complete endorsement, there must always be a slight variation. I am now talking about one out of ten or one out of a hundred thousand situation.

MR. ELLIOTT BARKER (New Mexico): I have noticed in your talk that you have used the term "water pollution control" and the "clean-up of our polluted waters" time and time again. Now, our problem in New Mexico is a little different. Up until the past few weeks, we have had no water pollution in the streams of our state. Now, I think that water pollution prevention rather than control, is the thing with which we are now concerned. We have one large operation which recently started in our state, and they have assured us that there would be no pollution. However, immediately upon starting the operation, the water was very badly poisoned and polluted. We are doing all we can to put a stop to it in New Mexico.

My question is just this: Under what conditions will the Federal Water Pollution Control Agency come into a state to assist in a situation of that kind in preventing further pollution of our streams?

Incidentally, I might state that the pollution of the Red River, which is a tributary of the Rio Grande, is included in Senate Bill 1446, establishing a wild rivers system. We would like to know what help we can get and under what conditions from the Federal Government in the event that we cannot control this ourselves.

MR. STEIN: I thought I made it clear that the establishment of standards had as a major purpose the prevention of pollution before it occurred. Now, to get to some of your facts.

I have always heard this story before I went to Alaska, Hawaii and New Mexico—in other words, that there wasn't any pollution in New Mexico. I refer you to your major river there, which is high in radium content and in connection with which we had to have a forceful pollution control action involving the uranium mining industry. I would suspect that we might consider the Rio Grande River in the northern reaches of New Mexico as a delightful stream and subject

to classification as a wild river. I would suggest, however, that stretches of the Rio Grande, as it goes down through the southern part of New Mexico, particularly south of Albuquerque, might present a different picture.

I would suggest, sir, in my opinion, the accretion of salts in water by repeated use for irrigating agriculture, is a successful pollutant and can wipe out fish life as well as anything.

Your other point is that we can set the standards. However, under the present law, if there is an intrastate situation, we can only come in upon the request of the governor. The President has proposed that the Federal Government will be able to come in to any navigable stream on its own motion if the legislation is passed. However, at the present time we can deal with intrastate situations only if your governor asks us to come in.

MR. RICHARD STROUD: Mr. Stein, I would like to say that I think you have made some very constructive points in your delivery. I think we have moved ahead a little in our philosophy of water pollution control as reflected by your awareness that we simply cannot negotiate on the matter of scientific fact. But, on the other hand, what we are going to negotiate would perhaps be done through committees. In other words, this would involve how we are going to use various waters. But this is quite another matter from water quality criteria and the standards based on those specifications for various uses.

Now, in reference to your comments, if we were to apply all we could and solve from 90 to 95 percent of our water pollution problems at the present time, then most of us would agree with this. However, I am a little disturbed by the implication, perhaps unintended, that the remaining five percent of our problem is not so very important.

It appears to me that this remaining five percent and research necessary to resolve inherent problems in that five percent are really key questions, questions that are going to make the difference between whether we, in fact, do have clean water or whether we will still have on our hands a very large pollution problem in years to come. It seems to me that this five percent, which will be the subject of research in the future, is going to give us the answers to how to dispose of nutrients remaining in the water after full application of secondary treatment to which you referred. We must follow this vigorously if we are to develop the full array of water quality criteria upon which standards may be based.

Would you care to comment on that?

MR. STEIN: I could not agree with you more. The first speaker and I do agree with you absolutely, even though we always have exceptions. I have no reservation at all in connection with what you say. Now, if I gave a different impression, I did not mean to do so. I just wanted to point out that I have heard people talking about pollution in terms of removing the phosphates and nitrates or other substances, when, in reality, they were not getting at the real problem which they could deal with at present—that of stopping these tremendous sewers from spewing their filth into the rivers. Of course, this is not meant to negate any problem of research. Give or take a percentage point, we are possibly treating 90 percent of our waste. However, with our present population, that 10 percent which we do not get out will surely foul up our streams. If we do not handle this aspect, then, in my opinion, we are not going to achieve pollution control. In other words, if we do not solve this problem of end run sewage disposal, we are not going to clean up our rivers.

Further, if we persist in this country in paving the countryside from Boston down to Richmond, we are going to have to do something about the water that runs off of that pavement.

Also, Mr. Stroud, you are absolutely correct. I can see no other activity which has to be pushed harder than the problem of getting at the research on the things we do not know. However, I don't think that should deter us one moment from cleaning up the problems we now know how to handle.

CHAIRMAN TRAIN: Thank you very much, Mr. Stein.

Out of fairness to our next two speakers, I think we had better move ahead and if there is any time left at the end we can then return to some questions.

Our next scheduled speaker on the subject of "Natural Beauty," was to have been Mr. Hugo Fisher, Administrator, The Resources Agency, Sacramento, California. However, as I mentioned to you earlier, Mr. Fisher is not able to be present. He is having, as I understand it, some budget problems and I think most of us know what that means and, therefore, will be sympathetic to him in connection with his problems.

He also is an attorney by profession and a former State Senator and leader for many years in education and in natural resource affairs. His agency has over-all authority over four administrative departments and five boards functioning in various aspects of state conservation.

His paper is going to be read and we are fortunate that it will be presented by a man who has a distinguished career in resources in his own right, Mr. W. T. Shannon, Director of the Department of Fish and Game of the State of California.

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## NATURAL BEAUTY AND THE ADMINISTRATION OF NATURAL RESOURCES

HUGO FISHER

*Administrator, The Resources Agency, Sacramento, California*

Perhaps the most fundamental question that arises for an advanced society, which has met in large measure the basic needs of its people is: how do we meet all the intangible needs of man? How can we create a society that will exist in perfect harmony with its environment?

These are the questions which have driven President Kennedy, and now President Johnson, to the challenge of a "New Frontier" and a "Great Society."

Nowhere is this challenge more pointed than in the field of natural resource administration; where the people have entrusted to their delegates the task of conservation; where they have sought an administration to ensure the wise use and perpetuation of the resource base on which our society exists.

The untold wealth of our land and the problems which lie before us today, call to mind the lines from Bishop Heber's missionary hymn—

"Where every prospect pleases  
And only man is vile"

And yet, it is by men and for men that we are entrusted with the duty of managing our natural resources.

In seeming contradiction to Bishop Heber, I have long held a basic conviction regarding government—all government. It is the conviction that in any decision or action contemplated by government,

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<sup>1</sup>In the absence of the author, this paper was presented by Mr. W. T. Shannon, director, Department of Fish and Game, Sacramento.

the first and most important element to be considered is the human spirit or, if you will, the dignity of man.

This is only a seeming contradiction. Its resolution lies in the very subject we are addressing ourselves to at this moment, the place of natural beauty in our modern world.

It would be ridiculous to seek natural beauty for man without considering the nature of man himself. And I am convinced that we will only reach the objectives we have set for our society when the people—through their own laws, their established government, and their ethical concepts—manipulate their environment with a full understanding and regard for the human spirit.

The State of California has taken a prominent role in the search to achieve and maintain natural beauty. In January, Governor Edmund G. Brown convened a State Conference on Natural Beauty to appraise our current efforts and to develop new directions for state government with respect to the quality of our environment. More than a thousand persons—leaders from every area and discipline in the state, and from throughout the nation, gathered in Los Angeles to take part in this natural beauty conference.

I want to tell you some of the important things which have come out of the conference, and some of the things that are being done about natural beauty in California today, but first I want to paint you a picture of the state of affairs as they exist, which have led us to the present point in time.

I am the administrator of the resources agency of California—an agency of State Government made up of four major departments and 39 boards and commissions. The Resources Agency expends on the order of \$300 million a year in natural resource development and management—far more than any other State Government in the United States.

Excluding the development of atomic energy, the 8,000-employee agency I administer invests probably as much or more in resource development than the Government of the United States itself.

And yet California is still overdrawing its natural resources and losing the "wise use" battle on nearly every front. Obviously, we have been deluding ourselves about the renewability of some of our basic resources.

I think it is true that, as individuals and as groups, we often become so engrossed in our own growth and development problems that we miss the broad view of man's total effect on the land, and of the more subtle effects of the changing environment on man. But from my vantagepoint the panorama of man's assault on California stands out in bold relief, and it is a disquieting sight.

Surely the time is upon us when we must come to terms with the carrying capacity of our natural environment, and when we must face up to the social and moral issues that the technical revolution and population explosion on this earth have thrust upon us.

Let me give you a simple set of figures and then relate a simple set of facts which may at first seem unrelated but which underlie every square inch of the subject we are discussing.

There are living in the world today some three billion people—about one tenth of all the people ever born on this planet. While it took all of recorded history up to the mid-19th century for the world's population to reach one billion, it took little more than the span of one lifetime to add the next billion.

Today, there are three billion people on this earth and, according to the *medium* estimate of the United Nations, there will be more than six billion within the next 35 years. And this is just the initial puff of the world's population explosion.

Let's relate that to California. California in 1940 had a population of seven million. Today it has 19 million. Within the next 15 years it will be nearly 30 million. Furthermore, of today's 19 million Californians, 45 percent are less than 25 years of age, and the average age is getting lower each year.

Think that over for a moment. Nearly half of California's population is composed of youngsters, few of whom pay taxes. Yet they all consume. For education alone they now consume 53½ cents of every dollar the state spends.

Now consider these facts:

If present trends continue, the United States within 15 years will have about 9½ percent of the world's population. At that time this 9 percent will be consuming some 83 percent of all the raw materials and resources produced by the entire world.

No matter what the reason for this, I assure you that the slight political envy evidenced in the scrap for Colorado River water will pale into insignificance compared with the envy of the rest of the world when they see us consuming the earth's resources at a rate that requires us to fill foothill canyons with refuse, fill our ocean bays and offshore waters with garbage, line our highways with junked cars and discarded beer cans, incinerate billions of tons of woodfiber wastes with one hand while denuding our forests with the other, and strip our rivers and beaches of sand while covering some of the world's most productive agricultural lands with freeways, airports, slurbs and go-cart runways.

The rest of the world is going to take a dim view of our taking 83 percent of the world's natural resources for this kind of use.

We may think up some answers to give them and ourselves. We may even consider making some adjustments, although we are not likely to do so until it becomes economically important for us to do it.

I say it is politically and *humanly* important that we do it long before it becomes economically important for us to do it.

And now, I should like to remind you of some plain hard facts about the environment and the administration of our resources.

As late as 25 years ago, Southern California possessed one of the most beautiful and satisfying environments on earth. You could be a good deal younger than I am and still remember well the undisturbed hills shaded with oak and wild walnut, the uncluttered roadsides, the pleasant fields and groves and open space between communities, the fragrance of orange blossoms, the clear air and the crisp views of the ever-present mountains that seemed so near, and the pride and joy of just being a part of the scene. Our possibilities then were as spacious as the blue skies overhead. But there was no price on the shade of a wild oak, or on the fragrance of orange blossoms, or on clear air. And as the developers said then, and will tell you even now, that which has no price has no real value. So we suddenly found ourselves engulfed in an era in which everything had to make a short-term profit and be totally useful to our totally obsessive growth.

And there went our countryside—most of it for what seems like a pitifully low price now—and with it went our Class “A” rating in natural beauty.

As the result, in what was once one of the best endowed and most beautiful pieces of real estate in the world, millions of Californians now see little in their busy lives other than sidewalks and streets, walls and signs, grey-brown atmosphere and neon lights, freeways and the rush of traffic. They have mostly forgotten, or have never known, what it is like to explore a meandering creek or ponder the Milky Way.

Each, in his little house much like his neighbors', sees only his own little man-made world. Around the houses grows the hodge-podge of shops and services and poles and wires and billboards that cater to the needs of an ever-growing population.

They live out their lives locked within the city and locked out on the hills and fields, hemmed in by people, caught in an inhuman flow of men and machines, alternately halted and released by the mechanical flick of colored lights. Perhaps they have lived so long with this kind of growth and life that they are benumbed to its actual effect.

It is not something pleasant to think about, people without

space. For people minus space equals poverty—a kind of poverty that warps the mind and soul as well as the body.

What should have been the role of government during this period when we were losing our "Class "A" rating in natural beauty? Well, it's easy to second guess a coach when the game is over. And as the saying goes, too soon we get old and too late we get smart.

In addressing other audiences that were probing the specific subject, I have repeated the biologists' warning that man must act immediately to curb his uncontrolled increase in numbers. These hard-fact scientists do *not* contend that the world's limiting human population will finally be computed on the basis of the number of mouths to be fed. That is not the question.

For years they have been telling us, and too few have been listening, that far short of the population density that will tax our potential food supply there will be a limit to the tolerance of the human spirit, the advent of social and cultural stagnation, the disappearance of compassion and sensible morality and the dignity of man.

Any ecologist in our department of fish and game will tell you, as they have known for many years, that populations of all kinds have built-in checks for controlling their own numbers. And these checks are not necessarily associated with a short food supply. They may be due to social and psychological factors—especially the factor of individual living space in a given area—and these may occur even when food is super-abundant.

Animals, including man, are not simply machines for the consumption of food. Each has behavioral and physiological limitations of one sort or another. Even in the lower animals the press of a crowd apparently tends to dull the spirit, and there is no reason to believe that man is any less sensitive.

Scientists and philosophers alike have long agreed that beauty and open space and naturalness are important parts of our emotional and conceptual environment.

They have long known that we cannot be independent of this earth on which we live; that we sprang from it and that our relations in it determine all our instincts and satisfactions.

Boys need to match themselves against mountains, even if the mountain is really just a nearby hill. They need to see and understand the wonders of nature.

Men need to know the stillness of their own mind—the quietness of God's hidden places. Such is the essence of serenity, and of deep understanding.

Certainly we cannot return our cities to the natural environment, and it isn't even desirable that we should. Man has increased in

understanding of himself and his world as he has formed his civilization.

But neither can man be free of the need for open space and beauty any more than he can be free of his need for civilization. It is in the achievement of a harmonious balance between them that he will find his optimum existence.

The lesson to be learned from all this is that two positive actions appear necessary to provide a lasting solution. One is certainly the wise use and sharing of this earth's natural resources. The other is the control of human population. Simple arithmetic shows that any other approach is unthinkable.

From what I have seen, I would judge that essentially the same ingredients that attract people to particular recreation areas also attract new industry to a particular community, and incoming families to a particular neighborhood, and customers to a certain shopping area. These ingredients are beauty and open space, and the pleasure and convenience of easy movement. This is in the manner of things that the human spirit seeks, and this is what the public will pay for.

I am not suggesting that parks and open space and naturalness are the answers to all our problems. We *must* have more housing and business and highway development. We couldn't stop them if we tried, and I don't think anyone is suggesting that we should.

In California alone, to meet the population trend, we must build 200 miles of highway every year. We must build three complete elementary schools every week. We must complete five million new homes and apartments in the next 15 years. In fact, we must build the equivalent of eight cities the size of San Francisco in the next 10 years.

What I *am* saying is that we do need a better balance between the utilitarian and the esthetic.

Fortunately today there is an increasing public concern for the qualitative aspects of our environment. And from this voice of the people I am confident we will find the motivation, and the methods, and the money to preserve natural beauty and maintain it as an important and basic part of our environment.

In California, as I said earlier, this has become a matter of state concern, as the achievements of the Governor's Conference on Natural Beauty bear witness.

Out of that conference have come over 100 carefully thought-out recommendations for action by State Government to insure the protection and enhancement of the beauty of California. It would be impractical for me to go through that list in detail. I would, however,



like to spend a few minutes in going over some of the more significant of these recommendations.

One of the key recommendations revolves around the need for basic statewide land-use policies in California. Envisioned in these broad areas are such important things as state zoning measures, land-use control, water quality control, policies covering urban expansion, preservation of open space and agricultural development, and a guide for the management and disposition of state-owned lands.

Today in California we are already entering the field of flood plain zoning. We are also coordinating actions taken with regard to state-owned lands and lands that are to be acquired by the state. Our goal is to consider all the uses of the lands to balance these uses and to preserve the esthetic values as well.

Another set of recommendations are concerned with the role of tax policies as a key element in land development and use decisions. It is clear that this is an area in which regulation can determine the direction and consideration of aesthetic and recreational uses of land, and, in fact, land management in general.

Today in California a new law is presently making possible the retention of agricultural land for agricultural purposes through an alteration in taxing procedure, and serious study is being made of tax and fiscal procedures which will lead to the kind of land and water use that are needed.

One recommendation specifically calls for exploring the possibility of increasing the state gasoline tax to obtain acquisition and development funds for recreation, conservation and urban open space.

One of the key roles of the state as pointed out in the recommendations is to provide service to local public and private entities to help in planning for and carrying out programs for the preservation of natural beauty, open space, and the implementation of conservation practices.

Today in California we are in the process of preparing a major state development plan, and many elements of the plan concern themselves with this role of the state. Already the units of the resources agency, the departments of fish and game, parks and recreation, conservation, and water resources are deeply engaged in assisting in the guidance of many local, regional, and private activities that affect our natural environment.

Another facet of this role involves public access to the lands and waters of the state. We are building public use into our state projects at the earliest stages through the coordination of all state development projects. Agreements, review and interchange of information on projects during their formative period are absolutely essen-

tial among the various departments of the state to insure that all opportunities for public use are exploited. The same procedures are mandatory for the proper funneling of information to federal, local and private developers to insure that aesthetic and conservation needs are considered early in developmental planning.

Many other valuable recommendations resulted from the Governor's Conference, but there is one key recommendation which seems to lie at the heart of our current concern for environmental quality. It can be stated in one word—education. Education of all Californians—all the people—in the appreciation of the quality of our environment, is the essential foundation upon which more specific efforts to enhance the environment must rest. We must inform the people fully, so they understand what the result of all our actions upon the landscape will be. They must know what the short and long term effect upon the lands and waters will be when they are called upon to decide the fate of those lands and waters.

We must start at the beginning and bring our children up into a world in which respect for and enjoyment of natural beauty is an essential part of human existence. Today, in California, we are seeking to incorporate the teaching of conservation and ecological principles into the school curriculum—not necessarily as separate subjects but as an integral part of education. Certainly a deep and sincere understanding of the total relations between man and the world around him is the only sure and lasting way to ensure the preservation of the environment.

One man has said this before, far better than I can. And I think he resolves the basic paradox between Bishop Heber's point of view that "only man is vile" and our basic belief that the dignity of man is the essence of our system of government. This man, Aldo Leopold, said, "It is the expansion of transport without a corresponding growth of perception that threatens us with qualitative bankruptcy of the recreation process. Recreational development is a job, not of building roads into lovely country, but of building receptivity into the still unlovely human mind."

## ARE PRESENT TOOLS ENOUGH?

IRA N. GABRIELSON

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

Natural resources conservation is more popular and more widely accepted in this country than ever before. Political careers have been waged and won on platforms promising clean water, natural beauty, and outdoor recreation. Foremost commentators and writers now explore conservation crises of all kinds, where only a few years ago they were content to leave the field to others. Prime TV time and the impact pages of newspapers and magazines are given to the subject.

In addition, an informed and responsive public showers letters, telegrams and statements on committees of Congress, state legislatures and local governing groups. Women march against bulldozers, and Presidents send comprehensive conservation messages to Capitol Hill. The climate is favorable and the growing season could be long.

This maturing of conservation as a political and social force is an impressive, heartening, and long-awaited development. But is it all still above reproach? Is it all to the good? As I see conservation projects ebb and flow in response to the pulsations of public and political enthusiasm, I wonder if this national outpouring is capable of creating enduring human benefits. Can our soil, our wildlife, our forests and waters be administered so as to assure continuing contribution to society's material and cultural well-being without destruction of the resource capital itself? What more needs to be done?

Despite our preoccupation with new programs and our search for new laws, we already have the capacity to make much more immediate progress by honoring and fully implementing statutes already on the books. There is tremendous unexploited margin for constructive good in going programs which are suffering from a lack of appropriations, a lack of interest, or a lack of vigorous administration.

To be sure, some new programs and authorities are needed, particularly those that recognize and give meaning to ecological implications of resources use and management. There is no justification for continuing to build big dams willynilly, for example, simply to keep a federal construction agency alive and its clientele happy. Electrical energy, water supply, and flood control often can be obtained by less costly and less destructive alternatives.

Much more pertinent research is needed, too, along with earlier application of its findings. The public and the Congress must be given alternative choices so that wise decisions can be made regarding the long-term commitment or permanent destruction of resource values. There is an urgent need for such a policy right now in the case of the

Lower Colorado River Project which would impair Grand Canyon National Park and Monument. New and proven technology must be accepted and applied if it assures better results with less resource capital loss than conventional systems.

All of these things need to be done, and more. But getting them done will be difficult because conservationists both in and out of government are devoting more attention to ballot-box conservation than to the muscle and bone of the resources themselves. Long-range resources thinking and management, in too many cases, is subservient to short-term expedients. In others, the tough decisions simply are not being made on conflicts of private and public interest.

Ballot-box conservation is the fusion product of public and political interest in natural resources matters. It has much value in that it is expedient and that it gets things done. But it can be grossly inefficient as well as needlessly harmful if not carefully oriented and controlled.

It has made possible the strengthened federal water pollution control program and the land and water conservation fund. It has started to bring coherence to outdoor recreation from the local to the national level. There also are the wilderness act, the multiple use acts, the several new seashore and recreation areas, and the water research and planning council acts, to name a few. Other significant proposals, such as the wild rivers bill and the rare and endangered animals program may be approved this year.

These things are good and represent progress, but the weakness and the inherent danger in ballot-box conservation is that it is engrossed more with the future and less with the present; it searches the surface, but seldom the depths.

New authorizations signify change and progress, but they are only promissory notes at the most. Each promises that such and such will be done and that so much money is pledged to a specific purpose. The catch lies in getting the program underway, in drafting and adopting regulations that are responsive to the intent and purpose of this law, and in getting the money and the manpower to make the whole thing go.

Passing a new law or calling for a new program is only part of the conservation battle. Many individuals, unfortunately, seem to believe that is what natural resources conservation is all about. They are more attracted to the tinsel than to the tree.

In the remainder of my time this morning I want to look around as well as ahead, to probe the depths beneath the surface so as to bring the question, "Are Present Tools Enough?" into better perspective.

Let's look first at national parks. Currently there is great excitement and justifiable enthusiasm for creating a Redwood National Park in California. The argument is not whether there should be a park, but about its size and location. Surely, preservation of an ecological unit of the world's tallest living trees from the highest watershed ridge down to the sea is in the national interest. This the Administration's plan would not do. It is a step in the right direction, but it does not go far enough. It responds to public interest not in terms of what is needed, but rather in terms of expedience. It offers a redwood park that would contain few redwoods not already protected by state parks.

Many conservationists will be reluctant to settle for a Redwood National Park of lesser stature than that proposed in H.R. 11723 and H.R. 11705, similar bills by Congressmen Cohelan of California and Saylor of Pennsylvania, or the identical Amendment 487 to the Administration's plan in the Senate.

Look at the Northern Cascades of Washington where some would create a new national park on wild and beautiful land already in public ownership and under the administration of a capable natural resources agency. An agency, by the way, that pioneered wilderness preservation long before much national attention was given this important program. What ratio of urgency is there between the creation of a Redwood National Park in an area now headed straight for the sawmill and one where the landscape remains largely untarnished from the time it was first known? Some people suggest that the exclusion of thousands of acres of unspoiled rain forest from the nearby Olympic National Park is the price to be paid for establishment of a Northern Cascades Park. Is this acceptable to conservationists? I doubt it.

Let's look at the national parks in the context of another serious problem. This is the thoughtless destruction of the Everglades National Park, the fabled river of grass, whose profuse plant and animal life evolved from the historic surface flow of fresh water from central Florida. This natural cycle has been broken, largely by the investment of public funds in a so-called flood control district, and the park is dying.

A recent joint announcement of the Interior and Defense Departments of a temporary program to alleviate the water storage still offers no permanent solution. The agreement is weak. It contains no guarantee that the park will receive any minimum allocation of water. It has a further weakness in that although the agreement calls for providing 500,000 acre feet of water to the park, the Corps of Engineers is requesting funds to pay for the pumping of only 300,000 acre feet.

Perhaps conservationists should go to work to cut off all further federal funds for the flood control project until money is provided and construction completed on all the pumps and ditches necessary to assure adequate water for the park. A second and perhaps quicker solution would be for President Johnson, with his great interest in national parks, to use his well-known powers of persuasion on the Army Engineers and their supporters.

If something isn't done, and soon, I earnestly suggest that the ruined Everglades Park be dedicated as a monument to the stupidity of letting engineers, land speculators, and other local promoters dictate the use of water in any region.

The controversy at the Great Smoky Mountains National Park, over the construction of a trans-mountain road across undisturbed back country, gives force to the suggestion that regional master plans should be prepared for all park system units. Highways, public accommodations, and service facilities should be placed outside parks as much as possible. The construction of another restaurant, souvenir shop, or highway subtracts from, but never adds to, the natural environment that the great national parks are supposed to preserve.

Perhaps new authority is needed, as was granted wildlife refuges years ago, to acquire land outside of parks for visitor accommodations and other non-conforming facilities. National park administration also should be re-examined, as it has evolved and is being applied, from the standpoint of new techniques for public visitation. It is clear that new concepts must be employed. This is a research project that should be initiated by some conservation group if not by the Park Service itself.

A final observation about national parks. Authorization of a full-fledged park often is more preferable for local political and commercial reasons than some lesser designation, such as national monument or recreation area. A number of proposals for parks really do not qualify under the long-standing national park guidelines. Without thinking this through, however, some conservationists support these proposals because they carry the park label. Should their efforts be successful, they will have helped to erode park standards and principles on a national basis.

Another important facet of resources conservation is the preservation of water quality. Despite all the fanfare of legislative accomplishment—and it was a major accomplishment—woefully inadequate progress is being made. Pollution abatement is a costly, complex, continuing, and unspectacular necessity. Its urgency and its virtue are chronically understated until there is water shortage.

The amended water pollution control act authorizes federal financial grants to municipalities for the construction of waste treat-

ment plants at the level of \$150 million a year. Appropriations last year and in previous years failed to provide the full amounts authorized for this vital program. Since 1957, when construction grants were authorized, Congress has appropriated about \$40 million less for this purpose than the law allows.

A summary of where we stand today in water pollution control was published recently by the Senate Subcommittee on Air and Water Pollution. It comments on the administration of the present program, contrasts accomplishment with need, and suggests new authority that will help in the future. The subcommittee places a \$20 billion price tag on adequate national water clean-up, an unreasonable and unattainable cost, some say. But how unreasonable, how impossible, is it? What is the true cost of not abating water pollution? What will be the permanent losses to our industrial society in terms of its financial, social, and material well-being if water is permitted to get dirtier and less and less usable?

As I said earlier, one of the most pressing things we need today is a system for choosing alternatives. There now is under discussion, for example, a national network of scenic roads and parkways that could cost up to \$8 billion over the next 10 years. Not considering for the moment whether this nation can afford to have additional millions of acres of land placed under concrete for the less-than-serious purpose of pleasure motoring, I question the commitment of \$8 billion to non-arterial roads when that money could be used for a concentrated assault on water pollution abatement. Who is to make the choice? Or do we allocate a little money to both, to keep people happy, and not make an effective start on either?

Another example of this is offered by scenic parkways and natural beauty, where there is much to be gained. Is a constructive contribution being made if we succeed in having scenic vistas and pleasant placement of industrial and residential areas, if those same factories and residences are dumping pollutants into the streams the parkways overlook? Effective conservation must have depth as well as a good front.

Many bills have been introduced to further expand the federal water pollution control program. President Johnson, in a recent message to Congress, recommends many changes in the national water pollution control program. He urges new attention be given demonstrations, enforcement, and research and suggests better local, state, and national cooperation. He also recommends that the new Water Pollution Control Administration be transferred to the Interior Department. There is some logic in this but it raises questions in the minds of those who fought for years to get the pollution program away

from the Public Health Service and its narrow concept of water pollution. There has been no strong objection to it going to Interior, but supporters of the program wonder if this will mean it is to be downgraded.

Many wonder what will happen when vigorous pollution control enforcement is attempted on strip mines, acid mine wastes, oil and gas wastes, irrigation returns, and so on. Will the Bureau of Mines or the Office of Oil and Gas, for example, support or oppose these efforts? Others wonder if this period of transition means more delays in implementing the program.

If this is the beginning of an effort to put all water resource management agencies together, what about the civil functions of the Corps of Engineers? Shouldn't they be transferred also? Perhaps they should be the first.

Congressional hearings undoubtedly will be held and testimony taken, but it is doubtful if the program actually can be improved this year. I want to emphasize, however, that if and when the basic law is improved—and I urge that this be done—that words on paper serve little purpose alone. Manpower and money are the fuels that make a program go.

These same fuels could make the program of the Bureau of Land Management go, too, but the proclivity of ballot-box conservation for the new and spectacular has ignored the needs of the nation's largest land-administering agency for years.

The results of this are all too obvious. Large areas of public domain grazing lands remain in a deteriorating and unsatisfactory condition. The few developments that money is provided for, such as soil and moisture conservation, siltation, dams, and range rehabilitation, lose much of their planned useful life because of the lack of manpower for follow-up management.

BLM has only 15 wildlife biologists, one for each 35 million acres it administers. Less than one-third of its staff is resources oriented. BLM is aware of these inequities, but it gets little help in overcoming them. There is danger, too, that reform of BLM's resources programs may be held back for three to four years until the Public Land Law Review Commission's study is done.

Wildlife interests have been surface feeding when they should have been probing the depths in the case of the Duck Stamp. From that program, conceived more than a quarter-century ago, the concept has emerged that waterfowl hunters should carry the burden of wetlands preservation. Through the \$105 million accelerated wetlands purchase program, they are buying lands today with money that must be repaid tomorrow.



Sadly, federal agricultural assistance for drainage has destroyed more wetlands in a shorter period than conservationists ever could hope to save by use of Duck Stamp funds. Sportsmen no longer can go it alone. The few dollars received from the Duck Stamps and through advance appropriations are incapable of stemming the tide of drainage made possible by the easy availability of hundreds of millions of dollars for agriculture assistance programs. And even if there was enough money to preserve wetlands for waterfowl by acquisition, it is doubtful if sufficient land could be purchased in critical areas by state and federal agencies.

The Cropland Adjustment Program of the Department of Agriculture, with its welcome but untested emphasis on wildlife habitat and outdoor recreation, offers renewed hope that a way can be found to incorporate wetlands maintenance as one of its compensable conservation features. Payments for the retention of wetlands, rather than for their destruction, are consistent with stated national wildlife and agricultural objectives. Farmers and ranchers hold the key to what happens to much of the wetlands in the United States.

New thinking is expressed in a resolution of the National Association of Soil and Water Conservation Districts, passed only last month, urging that "through the Cropland Retirement Program of the U.S. Department of Agriculture, or through the wetlands acquisition program of the U.S. Department of the Interior, establish a water bank which would provide for annual payments to farmers for non-agricultural use of wetland areas, and the maintenance of these areas in a condition most suitable for wildlife." Such an approach, I believe, is urgently needed. It is long overdue.

In these prepared remarks I have commented on some subjects at greater length than others. Some I have not mentioned at all. This does not mean that I believe they are less important. The subjects I have singled out appear to be of a more critical nature, and their mention is because of that aspect rather than any attempt to be comprehensive.

For example, more attention rightfully could have been given to the implementation of the Wilderness Act, the passage of which took much time and effort. Contrary to what some may believe, the work of preserving wilderness is mainly ahead of us. The agencies have been slow to issue their regulations under the act so reviews of the national forest primitive areas, national parks and wildlife refuges and game ranges can get underway. More than 100 areas await review and recommendation by the President to Congress for inclusion in the wilderness system. One-third of them must go through the review procedure by September, 1967. Time is short. We have the

tools for saving wilderness, but we are slow in putting them to work.

Another potential problem that should be mentioned is the resolution adopted last year by the American Fishing Tackle Manufacturers Association which expresses favor for abolishing the excise tax on fishing tackle items. This is the same excise tax through which sportsmen finance the valuable Dingell-Johnson Federal Aid in Fish Restoration program. From what I have been able to learn, the resolution apparently pledges the industry to work for dropping the tax on the very questionable theory that more money could be obtained for an enlarged program through direct appropriations. All of you who have gone through the appropriations struggle know the hazards of such an undertaking. It holds much more promise of harm than it does for good. The administrators of the state fish and wildlife departments had better be prepared to go to work should any serious effort be made to press this viewpoint.

Vigilance also is recommended to the threat of the huge Rampart Dam on the Yukon River of northcentral Alaska. By blocking the Yukon and by flooding 8 million acres or more of the Yukon Flats, this project would do great harm to fishery resources and to migratory waterfowl, furbearers, moose, and other animals. Rampart's supporters urge its construction, at the cost of billions of dollars, as a panacea to the economic ills of the State of Alaska. How much of a contribution would it actually make? Is a massive one-shot project the best contribution that the rest of the states can make toward the development of Alaska? I think not. Much more can be done for Alaska that would make a positive and enduring contribution without needlessly sacrificing so many scarce resources. I urge you to listen attentively to Dean Spurr on Wednesday afternoon when he speaks on "Alaska's Economic Rampart."

Dr. Spurr's comprehensive report represents the work of an expert team whose studies were commissioned by the Natural Resources Council of America. This kind of coordinated, independent review should be used more frequently by the national and regional conservation groups and societies to obtain an objective outlook on some of the complex projects that are being advanced. By pooling their generally limited resources they would be able to secure a more balanced and expert analysis than any one group could obtain alone.

I am not faulting the required study reports of the various federal or state agencies by this observation. We all know, however, that the commitments of an administration, as well as the history of operation of an agency, can strongly influence the recommendations that are made.

My suggestion, in conclusion, is that conservationists not look entirely to tomorrow for solution of all the problems in which we are interested. To do so, would be to blind ourselves to the many opportunities for getting full horsepower out of the things we have. True conservation progress still is measured in terms of what we get done, rather than what we hope to do.

#### DISCUSSION

CHAIRMAN TRAIN: Dr. Gabrielson, thank you very much for that inspiring and challenging statement. I think there were a couple of threads that ran through this morning's discussion.

One of these indicates there is a continuing need for research if we are going to meet the resource problems but, on the other hand, we have plenty of tools today with which to go to work.

Secondly, in order to make those tools effective, we need effective citizen and organizational support. There are representatives of national organizations in this room with roots in every community in this country. I hope we get the message.

I cannot help but note in closing that on this program we have had a lawyer, a fish and game administrator, a biologist and a mechanical engineer and that these men represent the social sciences and the natural sciences. They symbolize to me the kind of interdisciplinary teamwork that is going to be necessary if we are going to make a successful assault on the goal of high quality human environment.

It is after twelve o'clock. Thank you all very much for your attendance and also my thanks to all of the speakers. The meeting is now adjourned.

**PART II**  
**TECHNICAL SESSIONS**

## TECHNICAL SESSION

Monday Afternoon—March 14

*Chairman:* RAYMOND E. JOHNSON  
Assistant Director, Bureau of Sport Fisheries and Wildlife,  
Washington, D. C.

*Discussion Leader:* JOHN L. GEORGE  
Associate Professor of Wildlife, Department of Forestry,  
Pennsylvania State University, University Park

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### INLAND, COASTAL AND MARINE RESOURCES

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#### THE RELATIONSHIP OF WHITE-WINGED DOVE PRODUCTION TO CONTROL OF GREAT-TAILED GRACKLES IN THE LOWER RIO GRANDE VALLEY OF TEXAS<sup>1</sup>

DAVID R. BLANKINSHIP  
*Texas A&M University, College Station<sup>2</sup>*

##### OBJECTIVE

This project was undertaken to determine what effects removal of an important nest predator, the great-tailed grackle, would have on production of the white-winged dove in the Lower Rio Grande Valley of Texas.

##### INTRODUCTION

The range of the white-winged dove (*Zenaida asiatica*) in the United States is generally restricted to the Southwest with population concentrations in Arizona and Texas, where it is an important game bird. In recent years, the Texas breeding population has ranged from 300,000 to 600,000 birds with the extreme southern tip of the

<sup>1</sup>Portion of Master's thesis, Biology Department, Texas A & I College, Kingville. Study financed by a grant from the Caesar Kleberg Wildlife Foundation.

<sup>2</sup>Graduate student, Wildlife Science Department.

state, the Lower Rio Grande Valley, providing habitat for 95 percent of these breeding birds (Clark, 1964a) (Kiel and Harris, 1956).

Whitewings in the Lower Rio Grande nest in tracts of dense native woodland and in citrus groves. Clearing of the land for agricultural purposes has reduced the woodlands to a few remnant areas. In 1965 the bulk of woodland nesting whitewings was located in some 16 isolated tracts, totaling about 4400 acres. Only 6 of these tracts were larger than 100 acres. In 1965 about 41 percent of the 604,000 breeding whitewings nested in citrus groves and about 59 percent in remnants of native woodland (Clark, 1965). Whitewing concentrations in these woodland areas often exceed 100 pairs per acre, and 40 pairs per acre and higher are not uncommon in citrus groves. In years following periodic freezes, which destroy much of the citrus, the native woodlands support 75 percent or more of the nesting whitewings (Kiel and Harris, 1956) (Clark, 1964a). Many of the remnant woodlands are still in danger of being cleared. The World Wildlife Fund currently has a program underway to preserve some of these areas.

#### *Predation:*

Grackles: It has been well known for many years that over one-half of eggs that whitewings lay are eaten by great-tailed grackles (*Cassidix mexicanus prosopidicola*). These grackles also prey on the young whitewings before they leave the nest. Apparently through re-nesting attempts, the whitewings, on the average, succeed in producing approximately two young per breeding pair by the end of the nesting season. The relationship between grackles and whitewings appears to be unnatural, because both predator and prey have been concentrated in nesting colonies in the citrus groves and remnant woodland areas (Uzzell, 1947-1951), (Jennings, 1952-1953), (Harris, 1954-1955), (Kiel, 1956-1957), (Vernor, 1958), (Clark, 1959-1965, 1964b).

Other Predators: Animals other than grackles which have been observed by myself or some of the above authors as preying on whitewing eggs and young are green jays (*Cyanocorax yncas*), black rats (*Rattus rattus*), bull snakes (*Pituophis catenifer*), indigo snakes (*Drymarchon corias erebennus*), Schott's whipsnakes (*Masticophis taeniatus schotti*), and feral house cats. Black rats seem to be important predators in citrus groves when there is a heavy undergrowth. Wood rats (*Neotoma micropus*) are very common in the woodland areas but have not actually been observed eating whitewing eggs or young. In general, predation by these other animals is considered very secondary to predation by grackles.

*Earlier Grackle Control Experiments:*

The need for studies to determine the effects of controlling grackle predation and to find methods of reducing grackle populations in the whitewing colonies has been recognized for several years. Uzzell (1949) attempted to drive roosting and nesting grackles from woodland areas by using shotgun fire, smoke, fires, fireworks, and auto horns. He also tried to trap grackles using funnel and drop-type traps as well as drop nets. These methods were not successful in removing large numbers of grackles.

Attempts to remove grackles by shooting and to measure the effects this had on whitewing production were begun by the Texas Parks and Wildlife Department in 1957 on the La Paloma woodland tract northwest of Brownsville. These experiments were continued through 1959 with varying results (Table 1). (Kiel, 1956-1957), (Vernor, 1958), (Clark, 1959).

In 1960 an effort was made to control grackles on the La Paloma area by placing quail eggs injected with strychnine in artificial nests throughout the area. This method proved unsuccessful and resulted in no control. No efforts at control have been undertaken on the La Paloma area since 1960 (Clark, 1960).

During the summers of 1961 and 1962, intensive efforts at grackle control were undertaken on the Longoria Unit of the Las Palomas Wildlife Management Area north of Santa Rosa. Although large numbers of grackles were removed by shooting, they probably constituted a small fraction of the total grackle population on the Longoria Unit. The Unit's woodland area is approximately 10 times the size of the La Paloma area. Once again varied results were obtained. (Clark, 1961-1962).

These earlier grackle control experiments produced no definite pattern of whitewing nesting success response. All earlier attempts, however, were not intensive enough to achieve significant control, and sampling of whitewing production was often inadequate to detect differences that may have occurred. It was believed that through more intensive control efforts, working on a small area, and conducting more extensive sampling of nesting success, a more valid pattern of response could be obtained. With these considerations in mind, the following study was undertaken.

## 1964-1965 LA PALOMA EXPERIMENT

*Study Area:*

The project was conducted on the La Paloma woodland area, a privately owned tract of about 15.5 acres located some 7 miles northwest of Brownsville, Texas. The area's vegetation is predominantly

ebony (*Pithecellobium flexicaule*), anaqua (*Ehretia anacua*), two condalias (*Condalia obovata* and *C. obtusifolia*), colima (*Zanthoxylum fagara*), and granjeno (*Celtis pallida*). Other common species are huisache (*Acacia farnesiana*), coma (*Bumelia celastrina*), hackberry (*Celtis laevigata*), and mesquite (*Prosopis glandulosa*).<sup>1</sup> The area supported a heavy nesting population of both whitewings and grackles and had been the site of grackle control experiments by the Texas Parks and Wildlife Department in 1957 through 1960 (Table 1). Department records of whitewing populations and nesting success were available for this area since 1956.

#### GRACKLE CONTROL

##### *Control Methods:*

The grackle population on the La Paloma area was controlled by shooting, using shotguns and .22 rifles with .22 short ammunition. Grackles were shot in the woods, while they were flying to and from the area, and after dark when they were in roost trees. When whitewings began nesting in early May, shooting in the woods was limited to .22 rifles in order to reduce disturbance. Shotgun fire around the edges of the woods was found not to disturb the whitewings. The presence of study personnel in the woods was much more disturbing than the actual shooting.

Three methods of hunting proved more productive in 1964. Early in the season a dead grackle hung in the top of a tree or several dead birds placed in an open area made very effective decoys. This was the most effective method found. Later in the season when the male grackles were calling continuously and were preoccupied with mating activities, considerable success was obtained by stalking through the woods until one was in shooting range. Still later, when the grackles were feeding the young, hunters would circle the area, stay-

<sup>1</sup>Plant scientific names follow Gould, 1962.

TABLE 1. RESPONSE OF WHITEWING NESTING SUCCESS TO GRACKLE CONTROL.

Year	Area	Peak Active Nests Per Acre	Number of Eggs Laid On Transect	Percent of Eggs Fledging Young	Type of Grackle Control	Number of Grackles Killed
1956	La Paloma	256	279	29	None	0
1957	La Paloma	156	180	46	Air Rifles	859
1958	La Paloma	236	312	59	Air Rifles	1,000
1959	La Paloma	88	149	22	Air & .22 Rifles	636
1960	La Paloma	140	180	23	Poison Eggs	0
1961	La Paloma	160	189	42	None	0
1962	La Paloma	120	177	54	None	0
1963	La Paloma	208	272	43	None	0
1964 <sup>1</sup>	La Paloma	449	554	68	Shotguns & .22R.	2,824
1965 <sup>1</sup>	La Paloma	529	629	57	Shotguns & .22R.	1,398

<sup>1</sup>Average of three transects.



ing just outside the woods, and imitate the distress call of a young grackle. The adults, particularly females, would fly out to investigate and could be shot with shotguns. The grackle kill data for 1964 are presented in Table 2.

Shotguns were used for most of the grackle shooting in 1965. The grackles were extremely wary and did not expose themselves as in 1964. Decoy birds in dead trees were effective early in the season, but the grackles soon became wary. The birds did not respond to hunters imitating juvenile distress calls as well as during 1964. This may have been due to the fact that very few young were produced. Grackle kill data for 1965 is presented in Table 2.

#### *Grackle Populations:*

1964 Season: The first grackles were observed on the study area on March 2. Large numbers were not observed until early April when an estimated 500 grackles, mostly males, began roosting and loafing on the area. Shooting was begun on April 5 using shotguns. Some 80 grackles were shot during this period. The grackles rapidly decreased until there were only some 20 birds observed on April 12. On April 13, many female grackles began to move into the area. This movement was quickly followed by an influx of males, which began continuous calling and courtship displays. The grackle population rapidly increased even though the birds were subjected to constant shooting pressure. The number of grackles on the study area was estimated at 3,000 to 3,500 birds on April 17. On May 1, after some 1,800 grackles had been removed, a definite reduction in the population was observed. The grackles became extremely wary but continued to mate, build nests, and lay eggs. The remaining grackle population began to desert the study area about July 19, and after this date most of the grackles on the area were roving flocks composed of young birds and adult females.

1965 Season: The first grackles were observed on the study area on April 8. On April 27 the population was estimated at 500 birds. The population declined as a result of shooting pressure until May 27, when the population rose to an estimated 1,000 birds. These new birds were not as wary and, by June 20, most had been killed or

TABLE 2. GRACKLE KILL DATA ON LA PALOMA AREA, 1964-1965

Year	Man-hours Hunted	Grackles Per Man Hour	Males	Females	Young	Total
1964	221	12.8	1181	1502	141	2824
1965	202	6.9	446	509	89	1398 <sup>1</sup>

<sup>1</sup> Includes 273 grackles shot on small brush area near study area.

frightened off the area. On June 30 the population was estimated at less than 100 birds. Very few young grackles were produced on the study area in 1965. Once again, after mid-July, numerous roving flocks of 100 or more young grackles and adult females often were seen on the area. These flocks would leave after a few shots were fired, but because of their large numbers, were able to destroy many of the eggs before being frightened off.

#### WHITEWING PRODUCTION

##### *Sampling Procedures:*

Whitewing production on the La Paloma area was sampled with three belt transects of  $\frac{1}{4}$  acre each. Each transect was 121 yards long and 10 yards wide. The long, narrow design was necessary due to the extreme density of the understory. A line was strung for each transect, and nests were checked for 5 yards on each side of the line. This is the same type transect used by the Texas Park and Wildlife Department to sample whitewing production in woodland areas. Transect No. I was the same transect used to sample production on the La Paloma area since 1956. Transects I and II were located in areas of mixed ebony, anaqua, colima, and condalia while Transect II sampled predominantly ebony nesting habitat.

Each transect was checked weekly and each nest was numbered and its location, height, and weekly contents recorded as well as the species of tree in which each nest was found. Contents of the nests were observed with a mirror on a jointed bamboo pole.

##### *Population:*

1964. The first whitewing was observed on the La Paloma area on April 2. On April 15 the population was estimated at 150 pairs, and this increased to an estimated 1500 pairs by April 23. Active nests (nests with eggs or young) on the transects during the peak weeks of late May and early June indicated a minimum population of 449 pairs per acre or a total minimum population of 6,940 pairs.

1965. The first six whitewings were noticed on the study area on April 8. The population remained low until late April and then increased rapidly. The population was estimated at 150 pairs on April 21, and at 1,500 pairs by April 27. Active nests on the transects during the peak week of June 30 indicate a minimum population of 529 pairs per acre or a minimum total of 8,200 pairs.

These peak figures of 449 pairs per acre in 1964 and 529 pairs per acre in 1965 are among the highest concentrations of breeding white-wings ever recorded. It should be pointed out, however, that unchecked predation in past years probably caused many nests not to be recorded as active and thus resulted in population estimates lower

than the actual number of nesting birds. This is because pairs which are between nesting attempts are not recorded when transects are checked for active nests.

*Other Woodland Areas:*

Four other woodland areas were under study by the Texas Parks and Wildlife Department in 1964 and 1965 (Table 3). No efforts at grackle control were made on these areas. The area with habitat most closely resembling that of the La Paloma area is the Longoria Unit of the Las Palomas Wildlife Management Area north of Santa Rosa, Texas. Whitewing concentrations on the Longoria area were 108 pairs per acre in 1964 and 112 pairs per acre in 1965. The highest concentrations recorded in woodland study areas by the state were 148 pairs per acre in 1964 and 156 pairs per acre in 1965, both in the Mercedes Basin study area. This area suffered extreme grackle predation with only 5 percent of eggs laid on the area fledging young in 1965 (Clark 1965). Nesting statistics for these four woodland areas without grackle control are presented in Table 3 and a graph of nesting activity in Fig. 1. No doubt many eggs or young on all areas were destroyed before they were recorded, which resulted in a lower estimate of the population than actually was present.

*Whitewing Nesting and Nesting Success:*

The first whitewing egg was found on the La Paloma area on May 5, 1964 as compared to May 10 in 1965. Nesting activity in 1965 increased at a much slower rate, reaching a peak the week of June 30 as compared to May 27 in 1964. Some of this difference may have been due to 1965 drought conditions and resulting poor cover. Seasonal progression of nesting activity on the La Paloma area is presented in Fig. 1.

Fig. 1 also indicates whitewing renesting activity. The period from the beginning of incubation to the fledging of young is only 28 days in length for whitewings. Thus to maintain the high level of nesting activity for the long periods shown in Fig. 1 renesting must have taken place. Rেনesting is also indicated by the fact that the usual clutch size for whitewings is two, and the data in Table 4 indicated roughly five eggs laid per pair of adults on La Paloma in 1964 and 1965.

An attempt was made to gather information on whitewing renesting during the 1965 breeding season. Eighty-five adult whitewings were trapped, colored on wings, tail and breast with DuPont "Luxol" dyes, and released before nesting began. The colored birds were often seen flying and feeding, but only one was observed on a nest, and this nest was destroyed three days later. Dyeing of the bird's

heads would have made spotting of colored birds on nests much easier.

Renesting plays an important but poorly understood role in whitewing production. A comprehensive study of whitewing renesting is sorely needed.

Table 4 gives a summary of whitewing nesting statistics from the three La Paloma transects for 1964 and 1965. The percent of whitewing eggs fledging young is used as the key indication of whitewing nesting success. The average figure for whitewing eggs fledging young on the three La Paloma transects was 68 percent in 1964 and 57 percent in 1965. The average nesting success for the four woodland areas sampled by the state was 38 percent in 1964 and 23 percent in 1965. (Clark, 1964-1965). The average nesting success for the five years on the La Paloma area when no grackles were removed was 38 percent. It should be emphasized that nesting success figures are biased upward, particularly in areas with heavy predation, because many eggs are destroyed before they can be recorded.

#### Late Nest Losses:

The figure of 57 percent for La Paloma nesting success in 1965 is considerably below the 68 percent of 1964. This resulted from

Figure 1.

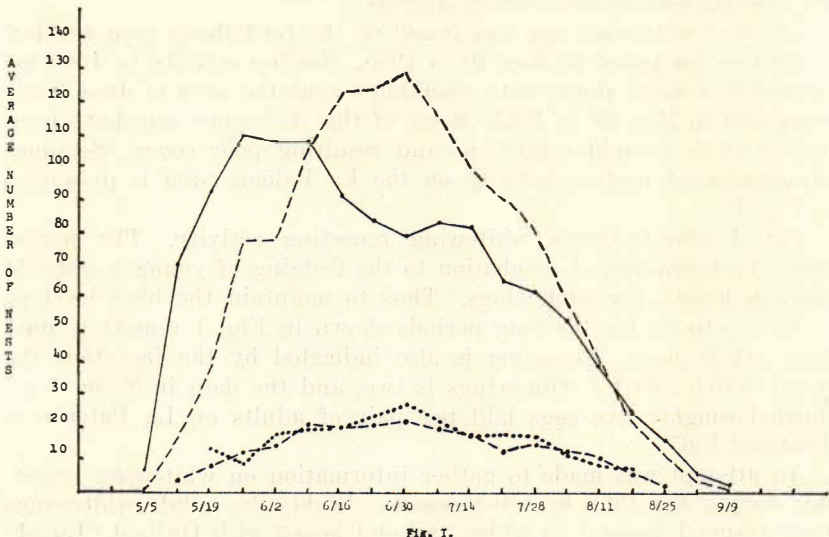


Fig. 1.

Active Nests by Weeks on 1/4 Acre Transects with and without Grackle Control

La Paloma 1964 ———

Four Other Woodland Areas (No Control) 1964 - · - · -

La Paloma 1965 - - - -

Four Other Woodland Areas (No Control) 1965 · · · · ·

TABLE 3. WHITE-WINGED DOVE NESTING STATISTICS—TEXAS PARKS AND WILDLIFE DEPARTMENT  
WOODLAND STUDY AREAS—1964-1965

Year and Area	Total Nests on Transect	Peak Active Nests Per Acre	Eggs Laid on Transect	Young Hatched on Transect	Young Fledged on Transect	Percent Eggs Hatched	Percent Young Fledged	Percent Eggs Fledging Young
1964 Longoria Mgt. Area	57	108	132	86	63	65	73	48
1964 Pharr Basin	25	36	54	33	23	61	70	43
1964 Goodwin Tract	53	108	141	75	59	53	79	42
1964 Mercedes Basin	99	148	260	87	77	33	89	30
1964 Totals	234		587	281	222			
1964 Averages						48	79	38
1965 Longoria Mgt. Area	64	112	157	71	64	45	90	41
1965 Pharr Basin	55	124	129	73	57	57	78	44
1965 Goodwin Tract	45	62	106	46	27	43	58	26
1965 Mercedes Basin	127	156	317	22	16	7	73	5
1965 Totals	291		709	212	164			
1965 Averages						30	77	23

TABLE 4. WHITE-WINGED DOVE NESTING STATISTICS—1964-1965—LA PALOMA STUDY AREA

Transect No.	Total Nests on Transect	Peak Active Nests Per Acre	Eggs Laid on Transect	Young Hatched on Transect	Young Fledged on Transect	Percent Eggs Hatched	Percent Young Fledged	Percent Eggs Fledging Young
1964 — No. I	194	444	480	323	300	67	96	63
1964 — No. II	215	476	612	470	420	77	89	69
1964 — No. III	185	428	569	426	412	75	97	73
1964 Totals	594	1348	1661	1219	1132			
1964 Averages		449				73	93	68
1965 — No. I	234	556	663	361	337	54	93	51
1965 — No. II	217	548	603	377	360	63	95	60
1965 — No. III	203	484	622	414	377	67	91	61
1965 Totals	654	1588	1888	1152	1074			
1965 Averages		529				61	93	57

a great reduction in success of eggs laid on or after July 20, 1965. The average success of these late eggs on the three transects in 1965 was 29 percent. Average success of eggs laid prior to July 20, 1965 was 66 percent. Late eggs on the La Paloma area in 1964 and other woodland areas in 1964 and 1965 showed slight drops in success but not so marked as above.

A partial explanation for this 1965 late-season loss may be due to the fact that from mid to late July the La Paloma area was infested with caterpillars, which practically defoliated many of the trees. This defoliation removed cover from the nests and made the eggs and young easy prey for the roving flocks of young grackles and adult females which were common during this period. A similar defoliation of woodland areas in the Lower Rio Grande Valley was recorded by Saunders (1940) who identified the worms as larvae of the snout butterfly (*Libythia bachmannii*). It is not known whether or not this defoliation occurred on other woodland areas in 1965.

#### *Other Sources of Loss:*

Some factors besides grackles which reduced nesting success were predation by other animals, such as jays, snakes, and rats; high winds, which tossed both eggs and young from the nests; kicking of eggs and young from nests by flushing adults; and disease. The relative importance of these factors has not been determined, but, considering the flimsy construction of whitewing nests, wind loss and other accidents were probably important factors in reducing nesting success.

#### *Production:*

The number of young fledged on the  $\frac{1}{4}$  acre transects indicates the actual production. The numbers of young fledged on the La Paloma transects in years without grackle control were 117 in 1963, 96 in 1962, 79 in 1961, 42 in 1960, and 70 in 1956. (Clark, 1960-63) (Kiel, 1956). In 1964 and 1965, with intensive grackle control, the average numbers of young fledged from the  $\frac{1}{4}$ -acre transects were 377 and 358 respectively. This would indicate an increase in actual production of some 200 percent over the best year without grackle control and some 300 percent over the average of the five years without control.

In the table below a comparison is made of the number of young fledged per pair of adult whitewings estimated to be on the study areas in 1963, 1964, and 1965. It should be emphasized that all the production values except the La Paloma figures for 1964 and 1965 are probably far too high, since the breeding population figures on which they are based are too low, as mentioned in earlier sections. Calculations based on a constant number of young fledged but an in-

creased adult population would give reduced ratios from those in this table.

Area	Number of Young Fledged per Pair of Adult Whitewings		
	1963	1964	1965
La Paloma	2.3	3.4 <sup>1</sup>	2.7 <sup>1</sup>
Longoria Unit	2.6	2.3	2.3
Pharr Basin	not sampled	2.6	1.8
Goodwin Brush	2.0	2.2	1.5
Mercedes Basin	not sampled	2.1	.4

<sup>1</sup> Average of three transects.

## DISCUSSION

### *Estimates of Whitewing Populations and Production:*

The doubling of peak active nests per acre and numbers of eggs laid on the transects in 1964 and 1965 over the same figures for La Paloma in the five years without intensive grackle control is believed to have resulted from the fact that during these two years, for the first time, most of the eggs could be recorded before they were destroyed by grackles. It must be pointed out that the whitewing breeding populations in the Lower Rio Grande Valley in 1964 and 1965 (600,000) were roughly double the populations of 1962 and 1963 (300,000), and this could account for the increase in active nests and eggs. However, the breeding population in 1961 was also about 600,000, and the number of active nests and eggs on La Paloma was lower than in 1963. In 1956, with a breeding population of about 234,000, there were more active nests and eggs on La Paloma than in 1961 (Table 1.) (Kiel, 1956) (Clark, 1961, 1963, 1964a).

Results of the current study would seem to indicate that transects on areas with high predation may give nesting success figures which are too high and breeding population figures which are too low. This could have far-reaching consequences, as the present method of estimating the Texas whitewing breeding population is based on comparison of cooing levels of areas to be censused with cooing levels of areas where the population has been established with nest transects. If these transects indicate populations considerably below the true figures, this could result in a gross underestimation of the Texas whitewing breeding population. Thus population levels in the above paragraph may also be suspect.

### *Production Increase:*

The 200 percent increase in actual numbers of young whitewings fledged on La Paloma in 1964 and 1965 over the best year (1963) without intensive grackle control would seem to have resulted from

a much greater increase in nesting success than is indicated by the figures in Table 1. The nesting success figure for 1963 and earlier years are probably too high, as explained in above paragraphs, perhaps by as much as 50 percent. Even if one credits the 100 percent increase in the Texas breeding population with a 100 percent increase in production on La Paloma in 1964 and 1965, this still leaves a 100 percent increase which would seem to have resulted from intensive grackle control.

Expanding the production figures from the La Paloma transects in 1963 and 1964 to production for the whole 15.5-acre tract gives the comparison of 7,254 young fledged in 1963 to 23,374 and 21,540 fledged in 1964 and 1965 respectively. The prospect of such a production increase in some of the larger whitewing colonies would seem to accent the need for development of a system of intensive grackle control in these isolated tracts.

#### ACKNOWLEDGMENTS

I wish to express my gratitude to W. H. Kiel, Jr., biologist for the King Ranch, Ted L. Clark, biologist for the Texas Parks and Wildlife Department, George Williges, Dr. Burruss McDaniel, and Dr. Talmer Peacock, members of the Texas A & I College Department of Biology faculty, for their advice and assistance in planning and carrying out this project. Thanks go also to Kenneth Robinson, Russel Blankinship, Glen Adams, and Orson Whited for their able assistance in the field. The Texas Parks and Wildlife Department was most helpful in allowing the use of their records for comparison of data.

#### SUMMARY

In the Lower Rio Grande Valley of Texas breeding colonies of white-winged doves and great-tailed grackles have been concentrated into citrus groves and small remnant woodland tracts as a result of clearing of the land for field crops. The grackle is a major predator on whitewing eggs and nestlings. During the spring and summer of 1964 and 1965 grackles were removed by shooting from a 15.5-acre woodland whitewing nesting colony located seven miles northwest of Brownsville, Texas. Texas Parks and Wildlife Department whitewing production data were available for the study area for all years since 1956; 2,824 grackles were removed from the study area in 1964 and 1,398 were removed in 1965. Whitewing production was sampled with three belt transects of  $\frac{1}{4}$  acre each. Minimum whitewing populations of 449 pairs per acre in 1964 and 529 pairs per acre in 1965 were established by number of nests active at one time. Previous high population estimate was 256 pairs per acre in 1956. Average



numbers of young whitewings fledged from study area transects were 377 in 1964 and 358 in 1965, which was an increase of some 200 percent over the best year without grackle control. Results indicated that transects in areas with high predation give estimates of breeding population which are too low and of nesting success which are too high; and that removal of a large portion of the grackle population from whitewing colonies will produce a marked increase in whitewing production.

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## DISCUSSION

DISCUSSION LEADER JOHN L. GEORGE: That was a very fascinating story, especially with populations running that high. I believe this is similar to the density of the passenger pigeon populations. I believe the last bird was eliminated here in 1906, just about fifty miles north of here.

This paper is open for discussion.

DR. WILLIAM SHELDON (Massachusetts): When you had intensive control in 1964, did the grackles build up to the same number or did they repopulate the area in about the same numbers in 1965 as the previous year?

MR. BLANKINSHIP: No, there was a reduction in 1965. However, there was still a substantial population.

DR. SHELDON: In other words, it would have to be a constant operation to be effective, would it not?

MR. BLANKINSHIP: I believe it would—at least to a certain extent. I think you can achieve some carry-over protection from year to year but, certainly, you do not eliminate the population each time.

DR. WENDELL SWANK (Arizona): The biological facts rather speak for themselves, but when we think about management we must get into economics. Did you keep any tally as to how much control would cost if you were to carry out this same program year after year?

MR. BLANKINSHIP: Of course, that depends upon the method you use. I really do not believe that shooting would be practical on a large scale unless somebody could work out a method for control by cooperating sportsmen's clubs. In

other words, I don't see how, unless this were done, this would be feasible for some conservation agency using paid employees. I have found that I expended two shells for every grackle I killed, and this would run into considerable expense in connection with large-scale operations.

DR. SWANK: Then the matter depends upon some feasible method of trapping these birds rather than by direct control by shooting?

MR. BLANKINSHIP: That is right. I think, in order to implement this on a large scale, you are going to have to develop an economical method of control. I think that is the answer.

QUESTION: We have seen a lot of publications in recent years in relation to regulation and the dynamics of wild animal population. I wonder if you have had any indication of either compensatory reproduction on the part of the grackle or whether you thought the dove population density would level off in terms of natural regulation of breeding populations?

MR. BLANKINSHIP: Well, I would say that in my area in 1964-1965, there was very little grackle reproduction. In 1965 there were practically no young grackles produced in the area. In 1964 there were very few. These areas were so small that we were able to cover them and destroy any grackle nests which we found were active.

MR. ROLAND CLEMENT (National Audubon Society): I suspect that a number of masking problems are involved here, and I have been keeping in touch with Dave's study. I think it is an intriguing one and reveals some new facts. However, I cannot help but take advantage of this opportunity, having noticed the reaction, to remind everyone that before we begin applying this information that we need to keep in mind the fact that Dave's situation is a particularly special one in that these birds have concentrated themselves in very small blocks. Is that not true?

MR. BLANKINSHIP: That is very true. I think this is a point that cannot be overlooked. This is certainly a very special situation.

MR. WILLIAM PRICE (Illinois Natural History Survey): I don't think you finished answering a previous speaker's question. In other words, I would be interested in knowing if increased reproduction in the white-winged dove carried over to a considerably higher population level and maintained itself through the subsequent year?

MR. BLANKINSHIP: I am not quite sure I understand you.

MR. PRICE: I should ask—Did the increased reproduction carry on through the years so that you had more doves throughout the year or were there some compensating mortalities in the doves?

MR. BLANKINSHIP: Well, as far as we could tell, there was no compensating mortality. There was a distinct increase in production. We found no more loss of young from any other source at any time.

DR. CLARENCE COTTAM: I would like to say that I happen to know the area, and I would say that there hasn't been opportunity for follow-up for some of these questions because controls were just finished last fall as far as the population in general is concerned. I should like also to point out another thing insofar as economics is concerned—that this is the first step, it seems to me, in relation to a research program. In other words, the first problem is to find out whether the control would have a local effect and, if so, to what extent. Then the next problem is to find out how to carry on the control economically. This was not designed, to begin with, on an economic basis. I think that the program has been an exceedingly important one.

Another interesting thing I got out of it as an insider (and I have seen it several times) is the homing instinct of the grackle. While the population in a few hundred acres here has not changed, in these local areas, grackles are controllable in connection with breeding areas. However, the population on this area was largely eliminated although it did carry over. I think there might have been some 75 percent carry-over in the next summer. In other words, not many young come back to the same area. Further, those who were not killed last year would be a little cautious about coming back and would stay out of that particular area.

## COASTAL WETLANDS—PROBLEMS AND OPPORTUNITIES

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### THE PROBLEMS

Salt marshes may be defined in any of several different ways. They may be defined physically in terms of the underlying layer of peat, their position between land and water, and the characteristic broad, flat surface. They may be defined in terms of their relationship to the tides as a salt-tolerant vegetational community periodically inundated with sea water. Or they may be defined botanically in terms of the species of plants characteristic of such communities. It is quite likely that they could be defined in terms of salinity, nutrient productivity, or any number of other criteria if one wished to work at it. And this is where the first problem with salt marshes comes to light—no one knows exactly where they are or what they are.

While the questions of whether a salt marsh belongs to the land or to the sea, whether underlying peat is part of the bottom, the soil, or the marsh, and whether the marsh is flooded to a given depth twice or only once a day may seem rather academic, they, in fact, become critical when ownership and control of coastal marshes is at issue.

That coastal salt marshes are among the most valuable and productive natural plant and animal communities on earth has become a well recognized fact among biologists, and, amazingly enough, among a large segment of the literate public. A detailed recitation of their values is not the purpose of this paper, but a brief review will help to focus better some of the problems brought up later.

In a completely natural state, salt marshes are perhaps most valuable for their contribution of nutrient materials to the adjacent waters. We are told that their production of proteins, phosphates, nitrates, sugars, organic matter, calories or almost any other standard of comparison we may select, will outstrip even intensely cultivated lands. While this productivity is not directly usable by man, through intricate food chains it boosts enormously the production of clams, oysters, crabs, and the other shell and fin fish so widely harvested in coastal waters. Translated into dollar values, this productivity becomes a major factor in the economy of any tidewater community. Most important, and frequently ignored, is the fact that this unbelievably productive complex operates without a single penny of capital investment at any level except the harvest!

In addition to its function as a major stimulant for the entire

estuarine economy, the salt marsh further nurtures the adjacent marine community by sheltering within its twisted tidal creeks and hidden ponds, the eggs and larvae of dozens of species of commercially and recreationally valuable fin fish and invertebrate animals at the most critical stage of their lives.

Perhaps the most widely recognized value of the salt marsh among wildlife biologists is its function as a waterfowl resting, feeding, breeding, and shelter area. Too frequently, however, this is the value stressed almost to the exclusion of all others. This can result in a gross misjudgment by the public of the total value of salt marshes. A large segment of the public "couldn't care less" what happens to the native North American waterfowl population because they do not see it, pursue it, eat it, or enjoy it. Insensitive as they are to this problem, they are equally sensitive to dollars and cents values of land and resources. An outstanding and economically attractive case for outright preservation of marshes can be built when the entire spectrum of marsh values is stressed equally.

Recreational value of the salt marsh itself is high when considered as a hunting, fishing, shellfishing, and birdwatching complex. The greatest contribution of the marsh to these activities is, however, well beyond its immediate borders in the form of nutrients which increase productivity and participant success in all of these pastimes throughout whole regions. It is quite probable that the recreational values of both the fin and shell fisheries in shallow coastal waters now equal or exceed their commercial value in the same areas. The combined value of the two together makes a significant case of itself for preservation of salt marshes.

While it is perhaps the most difficult value of all to sell to the local, and very tax-conscious, town council members, real estate developers, and businessmen, the aesthetic and scientific value alone of salt marshes is high enough to warrant their eternal protection. Along most shores, the salt marsh offers the finest vistas, most varied wildlife and the broadest open space left. Its subtle color changes through the seasons are second in beauty only to the gaudy deciduous forest displays of fall. These marshes will be the "lawns" of the marine seashore parks of the future—if the marshes still exist.

Historically, many salt marshes share with bogs and mountain tops the distinction of being perhaps the oldest continuous, unchanged plant communities in existence. We have only begun to tap the wealth of knowledge contained in these museums created as the glaciers receded from their last southward push.

The last, and not least, but surely the least recognized, value of salt marshes is as a buffer zone between high-value shore property

just above normal high tides and the tremendous destructive forces of the sea. Other similar values are the many small natural harbors at the mouths of salt marshes, there due to the scouring action of waters in the tidal creeks. Removal of the marsh to increase the size of these small refuges also removes this scouring action and results in heavy siltation throughout the old natural harbor *and* the new harbor created in place of the marsh. The result is a continuous dredging problem in a much less valuable harbor in an area made far less productive of the things which made the entire coast attractive in the first place. Man has a seemingly inborn tendency to overdo any good thing. The real tragedy of overdoing development in a salt marsh is that the damage can never be undone.

The uses to which salt marshes are put today in most cases bear little relation to the things which make the marsh of high and genuine value to society and our modern economy. The outright real property value of salt marshes today, however, reflects the uses which our short-run cash economy is forcing upon our inherently long-run marshes. Thirty to forty years ago most salt marsh in Rhode Island was next to worthless. Owners who inherited salt marsh frequently forgot about it. Boundaries were lost, taxes unpaid, and so little thought given to it that much marsh could be bought at ten dollars an acre, if you could find anyone who wanted to buy it. Today a reasonably remote salt marsh in Rhode Island might be priced as low as fifty dollars to one hundred dollars per acre, but within the past month I have been offered 20 acres of salt marsh at the price of 1700 dollars per acre. Average salt marsh prices probably run around 200 dollars per acre throughout much of the Northeast today.

The uses which create these prices are varied and destructive to the natural marsh. As in the case of the small harbors at the mouths of salt marsh creeks, the high cost of today's salt marsh comes about as a result of the desire to live or vacation near the shore. A good part of this desire is created by values maintained in large measure by the marsh itself. The greater the demand for shore properties, the higher the cost of all shorefront including marshlands. The higher the price of marshlands goes, the more likely they are to be turned to profit and destroyed. The more marsh destroyed, the less desirable the shore front for the things which made the marsh high priced in the beginning. The end result will be the seaside slum which is becoming commonplace throughout northeastern United States. The only absolutely irrevocable loss is the marsh itself.

Specifically, common uses for marshland in the Northeast today

are exemplified by the following. As indicated above, recreational use is high, economically important, and relatively non-destructive. Large numbers of people do not utilize the salt marsh proper for this purpose, however, and are unaware that their fishing, shellfishing, and other waterfront harvests miles from a marsh may be dependent upon marshland.

Commercial exploitation of the marshes usually takes the form of removal or filling—either one resulting in total destruction—to create shopping centers, marinas, industrial sites, airports and building lots for houses. Marshes are often removed to exploit underlying sand and gravel deposits. Connecticut, once the possessor of some 36½ square miles of salt marsh in 1914, had lost over 45 percent of this resource by 1959, much of it to sand and gravel strippers.

A favorite method of “increasing” the value of salt marshes in coastal Rhode Island is to fill them in by locating the town dump on one edge. Of 17 Rhode Island communities with coastlines, 5 have, or, until very recently, had, one or more town dumps located in a coastal marsh. Nearly all these coastal towns condone private dumps in salt marshes, and, even when such dumps are not openly allowed, they are tacitly approved. Stopping them is a formidable task, but not beyond accomplishment, as has been demonstrated recently in Rhode Island.

The problems in stopping such dumping are exemplified by one case as outlined here. The dump was filling in an exceptionally fine salt marsh. Unless the dump extends below mean high tide, the state is powerless to act. In this case, however, debris was definitely being washed to below mean high tide, and the edge of the dump *looked* as though it protruded into the zone below mean high tide. On the strength of this, a complaint from an organization which was neither a taxpayer nor resident in the particular town was registered first with the town (without acknowledgment) and then later with the appropriate state agency. On the basis of the written complaint and an extensive set of photographs provided by the complainant, the state agency investigated and sent an inspector. Following this, a letter from the state agency went to the Town Council ordering containment of the dump above mean high tide. The Town Council maintained (sometime later) that it was not an accepted town dump—although it was on an island, constituted the only disposal site available to island residents, and was operated by a town employee—and therefore the Council could not take action.

The next step was to examine carefully the ownership, including 300 dollars worth of surveying paid for by the complainant, and after considerable effort, the upland owners were contacted and the

intrusion of the dump on state-controlled tideland verified. Each of the owners denied knowledge of the existence of the dump—large and several years old—did not know who could be dumping, and could not take the time or expense to stop it even though free legal services were available from the complaining agency.

There was no way to force them to act except through the town, which had, of course, refused. The state agency involved wrote another letter or two ordering action, got quite upset at the lack of it, but took no action of its own. The only stimulus which kept the affair alive for almost two years was constant needling by the private agency. Dumping continued all during this two-year interval. The case finally came to a head when the attorney from the private agency, a rather aggressive and impatient gentleman not known for tact, literally stood on top of the dump and threatened the operator in plain and straightforward terms with criminal proceedings unless dumping was stopped. Shortly after this, the Town Council decided that it might be able to act after all. Within a short time the dump was relocated—a few hundred feet to one side and just above mean high tide and the marsh, where it is today, an eyesore in an otherwise unspoiled landscape and crawling gradually back out toward the marsh. The object of locating the dump in the marsh in the first place was, of course, to create more “valuable” land.

While dumps are a problem, they can be identified and their continuation challenged rather readily when necessary. Pollution in the form of domestic, municipal, and industrial sewage is another matter. Effluents from these sources can have profound effects on the salt marsh and are next to impossible to stop in most cases. Marinas are springing up in and near salt marshes everywhere and each slip within each marina may be equated with one toilet servicing on summer weekends from 2 to 8 or 10 persons and flushing directly into open shallow tidal waters. In most states, there is no means as yet for effectively controlling this problem. An application for a private marina now pending before the State in Rhode Island would place up to 700 boat slips within 50 to 150 yards of the mouth of one of the finest salt marshes in the state. Plans for dredging and filling much of the marsh itself to create additional facilities are included. The existence of a well-established residential and summer colony, including swimming beaches also within 150 yards, has not fazed the marina applicant one bit.

Salt marshes, because they are already partially controlled by the state in many areas and because they are still cheaper and defended less vigorously than residential and commercial properties along the

shore, are dear to the hearts of highway builders whenever the opportunity to use them presents itself.

There are two important points which form the basic objections to all of the above modern uses of salt marsh with the exception of individual recreation. First, many of them destroy forever the marsh itself, and there is no known way to rejuvenate or recreate these unique natural communities. Second, even when these uses fall short of total destruction and only degrade, they represent insignificant short-run cash transactions of little value when compared to the total ability of marshlands to contribute to the over-all economy and welfare of our society for unnumbered decades and even centuries to come. These salt marshes represent perhaps the most valuable and most vulnerable natural trust placed in the hands of this generation.

Digging even further into the problems of preserving these marsh areas intact brings us to the infinitely more complicated matter of common law and riparian rights.

Most states have ownership or control of all tidal waters and lands from mean high tide to a seaward distance of one marine league (three nautical miles). But the Federal Government pre-empts the right of navigation control within this limit. Also within this limit the states may, but do not always, set harbor lines, bulkhead lines, and construction lines. The Federal Government also sets harbor lines within this area, and these do not necessarily coincide with state harbor lines. All of these lines are more or less arbitrarily set by the U. S. Army Corps of Engineers and state agency officials and thus may vary enormously not only from state to state and place to place within one state but even from one part of a single harbor to another. Exceptions can be made in all cases.

To add one further complication, and more directly related to our problems, the right of navigation takes precedence over all other public rights within this area. Other public rights have included in various places and at various times rights of fishery, rights of swimming, hunting and others.

Perhaps the most critical of all problems in this category as related to salt marsh is that of the location of mean high tide. Mean high tide is defined as "... the average height of all the high waters at that place over a considerable period of time." A considerable period of time is now taken to be about 19 years. The problem of finding mean high tide in a salt marsh arises because mean high tide is an altitudinal measure. To place it as a line in a salt marsh is in effect an attempt to plot an altitudinal variant onto an essentially



flat surface which can easily be distorted even by the weight of a transit and the man operating it.

A further difficulty confronts one because tides themselves do not rise and fall equally even within relatively short distances along a single shoreline. Shore and bottom configurations, currents, winds, and many other factors may influence the actual location of mean high tide in any given instance. An engineer's mean high tide line on a map, however, is determined from the altitudes of nearby benchmarks. The altitudes of these bench marks are in turn extrapolated from tidal measurements made at approximately 100 tide stations throughout coastal United States and its possessions. In other words, sea level is an absolutely essential and uniform point of zero, but this standardized zero is an artifact, not an actuality, based on a wide range of figures. Thus bench marks represent a point calculated from a standard sea level zero for the entire country but do not necessarily reflect the actual tidal conditions on any specific site.

This means that an engineering survey may determine with great mathematical accuracy a mean high tide line at any point, but this line will not necessarily be the actual mean high tide at that point—the error being dependent upon a number of factors including distance from a control tide station and bottom, shore, and current configurations in the surveyed area. Only long-term tidal measurements in the immediate vicinity of the area in question can determine with real accuracy the actual location of mean high tide.

In the case of essentially flat and exceedingly broad surfaces, such as salt marshes, the differences between a mean high tide obtained by an accurate survey and one obtained by equally accurate measurements of the tides in the area could result in minute discrepancies changing the ownership and control of many square miles of marshland. The significance of these differences begins to become apparent when one realizes that as many as five different plant zones, each one potentially representing many acres of marshland, may be easily distinguished in an altitude change of only 2 inches on the marsh surface. This same information also points up the extreme sensitivity of salt marsh vegetation to salinity, duration, and frequency of tidal flooding.

When it comes to controlling the uses made of salt marshes, the phrase about "everybody wanting to get into the act" immediately comes to mind. The U. S. Army Corps of Engineers is concerned if a problem of navigation is involved and some designated state agency will also be concerned with this aspect of marsh use. The state wildlife agency will become involved if use or removal of shellfish or other protected species is affected. If pollution is a factor, as

it often is, then both the state and local health agencies become involved along with the wildlife people again. In disputes over various boundaries between state and private holdings in the marsh, the state attorney general is sure to be an active party. Several state, some local, and/or private agencies may individually or collectively have something to say about if, when, and how mosquito control is practiced in the marsh. The town authorities in the community where the marsh is located also have zoning prerogatives and other authorities over the marshland. One tends to forget in this patchwork pyramid of jurisdictions that private owners of salt marsh may also have a few rights and desires.

The above paragraph is perhaps the most indicative contained in this paper in putting forth reasons for the difficulties involved in controlling salt marsh use by means of anything short of outright purchase in fee simple by the state or a private protective agency. Even then, neither gains exclusively all rights in the marsh and may have to fight constantly to ward off damaging proposals.

Mosquito control in salt marshes is a widespread practice which has serious implications when its effects upon the integrity of the marsh are concerned. It is probably safe to say that there is *no* form of mosquito control now known which does not or would not alter significantly the ecology of a salt marsh. If mosquito control is to be practiced in these vital natural communities, and it is becoming more obvious that it will in spite of all efforts to the contrary, then we can only practice what is least harmful and with maximum conservative control.

The two major forms of mosquito control now used in salt marshes are ditching and aerial spraying. There is considerable discussion over the effect of ditching marshes, both on mosquitos and on the marsh. Casual observations and conversations with long-time residents near salt marsh would indicate that most ditching does not seriously deplete the mosquito population of most salt marshes, especially in areas where the ditches are not carefully maintained. That the ditches change the duration of flooding of most of the marsh surface is obvious and this may have many effects. Again, casual observation would seem to show that, while there may have been shifts in the zonation within a marsh due to ditching, there seems to be little evidence that ditching has, at least in a 30-year span, altered the actual extent of most Rhode Island marshes. Some marine biologists believe that the extended daily flow of tides into and out of the marshes caused by the ditches may actually increase the availability of the nutrient material produced there to adjacent marine organisms and thus utilize the total productivity of

the marsh more fully. Waterfowl biologists maintain that ditching reduces the value of the marsh as waterfowl habitat. More information is needed on these matters.

The matter of spraying salt marshes for mosquito control is far more clear cut. It is beyond question, even though much of the evidence against it is circumstantial at the moment, that all application of chlorinated hydrocarbon and organo-phosphate insecticides in salt marshes should be *stopped completely*, except in the face of a demonstrated public health emergency where no alternative exists and where there are reasonable grounds for supposing that such spray programs would be effective in reducing the emergency. The demonstrated toxic effects of these spray chemicals on crustaceans and other minute life critical to the existence of the complex salt marsh food chains are so plainly disastrous to the ability of the marsh to retain its productive values that no other course is open.

The burden of proof, *effective laboratory and field proof*, that a pesticide is harmful to wildlife no longer rests with the biologist and conservationist. The burden of proof long ago switched to the manufacturer, and we must insure that the switch included the standards of testing developed by the biologists. Wildlife biologists have provided sufficient evidence and more to support their long-held contention that the first step in any specific pesticide application program involving chlorinated hydrocarbons or organo-phosphates must be the submission by those proposing it of a thorough and documented justifying statement of the absolute necessity for such a program. This documented justification must balance equally the need for such a program whether it be purely financial or otherwise, and the acknowledged damage, both long and short-term, which *will* be done to the environment if such a program is carried out, even under the most tightly controlled conditions.

I suggest that the Wildlife Management Institute undertake, at the earliest possible moment, a study to determine form, standards, and policies for such specific spray-program justifications and suggest means by which these policies and standards might be adopted officially by states and/or local communities. Certainly a most critical area to be considered in such a policy is the salt marsh, but the implications go far beyond this.

In New Jersey an experiment in mosquito control in salt marshes involving the permanent impoundment of water to depths of 6 to 10 inches over the marsh has recently been carried out. First estimates of the results indicate that mosquito control is nearly complete and that the practice increases the use of the marsh by certain types of waterfowl. Not stated, but implicit in such a technique, is an

almost complete nutrient production loss to surrounding waters. The tendency, as in so many attempts to "manage" a natural community, is to increase its value in a single direction but decrease it in innumerable other directions, the sum total of which is likely to be a reduction in the over-all value of the community to society in general. The Jersey techniques hold promise if they can be modified to continue effective mosquito control while preventing serious long-term ecological change in the marsh and restoring its productivity to adjacent waters.

Attitudes of public officials will have considerable influence on the speed and effectiveness with which salt marsh preservation programs can be designed and implemented in any given area. If responsible administrators charged with resource management offer leadership and cooperation, much can be accomplished on all levels and by all methods in a marsh preservation campaign. Without such leadership, however, the job will be a long, more costly, and far less effective one.

Elected officials obviously can help or hinder significantly any such efforts. The attitude of the Rhode Island General Assembly member who told an individual working for preservation of marshes that, "If any attempt to enforce the State's new salt marsh laws is made in my town, I'll introduce legislation to repeal them," is calculated to slow things down considerably. Failure to build a strong base of public support for a marsh preservation effort will kill the program well before it gets started, if for no other reason than that any such program is ultimately going to cost many hundreds of thousands of dollars of public money.

#### THE OPPORTUNITIES

The opportunities available to preserve salt marsh as a prime resource of benefit to all the people have never been better than they are now. Public interest in and federal recognition of resource use problems have never been higher than they are at present. The number and variety of sources for funds to accomplish the necessary work is never likely to be greater. While severest resistance to solutions for resource use problems is within local as opposed to state, governmental structures, effective educational campaigns within communities can overcome this situation. A brief review of what is already going on in coastal states will indicate what can be done with imagination, hard work, and a determination that salt marshes really ought to be preserved for posterity.

A short letter of request for information on salt-marsh laws and programs mailed to the official wildlife agency in all coastal states

and provinces in the United States and Canada elicited the following information. Twenty-four replies were received to the thirty letters sent throughout the continent, a good indicator in itself of the importance attributed to marshlands by these agencies. Of those replying, three areas said they had little or no salt marsh. Six said that there were laws to protect salt marsh in effect within the state or that it was felt that title to all of the salt marshes rested with the state anyway. Only two of these had specific laws for control of salt marsh use. The basis for the ownership assumption by the other four was not clear. If the assumption holds that all salt marsh is within the tidelands included in the state's title to all lands below mean high tide then this ownership would seem to be on somewhat shaky ground. A surveyed mean high-tide line in Rhode Island frequently falls near the outer (water) edge of a salt marsh. Two replies to the inquiry indicated that legislation specifically to protect salt marsh was contemplated in the near future. Sixteen replies indicated that there were no specific state laws or administrative regulations to control salt marsh use.

Twelve states indicated that programs to purchase salt marsh were in effect and varied from as few as 53 acres acquired to 30,000 or more acres. Thirteen states indicated some other form of protection programs not involving state laws or state funds. Four of these mentioned federal salt marsh purchases within the state, and nine cited some form of cooperative administrative agreement with other state agencies or mentioned county or municipal action within the state. Several of the non-replying states are known to have some salt marsh laws and active acquisition programs.

From the above, it would seem that outright purchase of salt marsh was the major approach being taken to solve the marsh protection problem. There is no question that the fee purchase of these areas is the best and most effective means of preservation—but can enough salt marsh be acquired by this means alone to do the job? Since the job really is to protect as much salt marsh as possible, sufficient funds would seem somewhat unlikely, at least in time to be effective where marshes are disappearing at the rate of one percent or more annually.

There are other methods available to hold the line on marshes which are under less pressure while available funds are put into the purchase of critical areas. Easements, the permanent purchase of only partial rights in property, are one tool and can be far less expensive than full purchase. An easement purchasing the rights to dredge, fill, and build on a marsh but leaving all other private rights (including the right to prevent trespass) in possession of the owner

can be a most inexpensive and satisfactory arrangement with an owner who holds the marsh primarily for hunting, fishing, or other compatible recreational or aesthetic uses. It will continue to protect after the owner from whom the easement was purchased no longer holds title to the property.

The possibility of gifts of marshland should not be overlooked. The number of persons who will give land to insure that it remain in a natural state is larger than commonly thought. It is a common experience in the Northeast to find, however, that a very healthy suspicion of any and all government precludes gifts of land from some individuals to the state or community in which the land lies. In such a situation, these individuals may often consider giving the land to private foundations to whom conditions of the gift can be dictated and who do not have the stigma of being subject to political pressures. In the case of high-value natural habitat on the verge of final destruction, does it make much difference who pulls the chestnut out of the fire as long as it is saved for its intrinsic values?

If a local community can be sold on the real value of its marshlands, there are several means by which they can preserve these areas quite efficiently, including those listed above. In addition, and assuming the necessary powers rest in the community or can be obtained from the state, the authority of the local tax assessor to reduce taxes or assessed valuations in return for agreements not to develop or destroy property can be most persuasive. The possibilities of state compensation in lieu of taxes for state-owned land in local communities is being seriously discussed in Rhode Island and will be used soon in one instance.

Local power of zoning can be used to zone certain shore areas against development to protect the health and welfare of the community during storms and floods. In reality, local zoning is a highly unreliable method of preserving marshes since every local zoning board has an alter ego in the zoning board of review, which is prone to reverse zoning decisions and grant exceptions at the drop of a 5,000-dollar development plan or "improvement" proposal.

Zoning on the state level is something most politicians would rather not talk about, but it is being tried now in at least two states, Massachusetts and Rhode Island. Laws have been passed in both places within the year allowing statewide zoning of all salt marsh, regardless of ownership and ignoring tidal boundaries. All salt marsh in Massachusetts is well above the line of jurisdiction of the state (mean low tide) and thus the principle of state zoning on private lands is being thoroughly tested. In Rhode Island the di-

viding line between state-controlled tidelands and private holdings is mean high tide, which line, as surveyed by engineers, usually falls somewhere between the outer and inner edges of a salt marsh. Both laws are quite similar since the Rhode Island statute was patterned after the original proposal made in Massachusetts and prepared by the Massachusetts Department of Natural Resources. Both contain a feature not found in most zoning, done under the police powers of the state. This is a section permitting an owner to seek compensation from the courts if he feels that he has been deprived of property without due process by the zoning action. The Rhode Island act defines salt marshes in terms of the vegetation existing thereon and the underlying peat deposit and thus introduces another new concept into the picture. Neither law has yet been effectuated, and thus they remain untested in court.

Both Massachusetts and Rhode Island also have a second law which makes an offense of dredging, filling or otherwise despoiling a privately owned salt marsh without first obtaining a permit to do so from the respective Departments of Natural Resources. This law has been tested and upheld in the lower courts of Massachusetts and is being tested in Massachusetts superior court at the present time. The Rhode Island law was again drawn from the original in Massachusetts but adds again the botanical definition of a salt marsh. Decisions on granting or denying the permit are determined by public hearing held by the administrative agent.

Rhode Island's disastrous experiences in the great hurricanes of 1938 and 1955 led to the passage of state legislation enabling the cities and towns to effectuate flood plain zoning to prevent building or development in shore areas subject to tidal flooding during storms. This could easily be used by the cities and towns to protect salt marshes, but of the 17 coastal communities in the state, only three have used the law at all and none of them for the express purpose of saving marshland.

In addition to the above laws, a marsh-purchase program is in effect in Rhode Island but, excepting one notable purchase several years ago, is just getting under way.

In most states it is probable that no one method of marsh protection will be adequate to do the entire job necessary. The intrinsic value of these marshes is so high, however, that the objective of all marsh preservation programs should be the full protection of the maximum acreage by any and all means possible. In short, all the remaining salt marsh in the state.

Those who still talk about assigning marshlands to categories in order to be able to say, "this marsh can be lost, that marsh we

would like to save, and the other marsh we must save at all costs", are forgetting that while this is excellent procedure relative to most types of habitat, it should not apply to salt marsh. Three things make this so.

First, salt marsh is a comparatively rare type of habitat. Compared to woodlands, fresh marsh, grassland, and other native plant communities, it runs far behind in terms of gross areas involved. Yet its total significance is probably higher by far than any of these other habitat types.

Second, much of our original salt-marsh heritage has already been severely depleted. While we can never know for sure exactly what the percentage of this loss is, it is safe to say on the basis of present knowledge that it has already been too much.

The third reason for making every possible effort to hold the line here and now on salt marsh is that we have no truly objective criteria for quantifying individual marsh values without the expenditure of vast amounts of money, and, even more important, time. Such a quantitative listing of salt marshes would be of the highest value to any administrator charged with a preservation program and would enable him to establish hard and fast priorities on a realistic basis. In the absence of such criteria, however, I can see no course but to assume that every square foot of relatively undisturbed salt marsh is equally as valuable a natural resource as every other square foot. Holding back a preservation campaign to await indisputable quantitative evaluation standards which might be forthcoming in five to ten years would mean significant losses of marshes in the meantime and fantastic rises in the prices of salt marsh. We must literally "go for broke" right now or we shall have missed our chance and lost a major natural resource for all time. We must never lose sight of the fact that a salt marsh is a renewable resource only if it is left alone. It might far better be classified entirely as a non-renewable resource and managed accordingly.

Purchase of the entire salt marsh complex may be practical in a few states, such as Rhode Island, but would be prohibitively expensive in most places. Purchase is, however, the best solution whenever it can be accomplished. Zoning, on both the state and local levels, will probably be most valuable as a delaying tactic to gain time while quantitative standards are developed and other more reliable methods of preservation brought into play. These two basic approaches in combination with any or all of the others mentioned give any resource administrator a number of tools, the effective use of which can accomplish his ultimate objectives and do it with a minimum of objection from the owners and communities involved.



Two basic problems which must soon be clearly stated and faced by all resource oriented agencies and groups in the very near future are suggested by this salt marsh problem. The traditional right in this country of a landowner to do whatever he pleases with his own property, including the right to destroy it completely if he so desires, is being seriously challenged by the conservation principles evolving today. Individuals and businesses own land only because the sovereign states allow it and only as long as their use of it does not seriously interfere with the similar rights of their neighbors. While we had ample open space and an overabundance of resources, this tradition could be loosely interpreted and it has become common practice to do so. But we can no longer afford to be so loose for the price will soon become too high. The first and most important question to be answered is, will the ownership of land in this country be a recognized and legally enforceable stewardship or will we continue to allow the destruction of basic resources of high value to all of society for short-run individual and corporate profit?

For too long we have been taken in by a major, inaccurate philosophical assumption in this country.

This philosophy holds that the public has little or no right to exercise interest, concern, or control over what individuals or businesses do with land or other resources in their possession. Accompanying this basic philosophy has been an attitude in American life that only the present counts, and the resource backbone of the nation may be bent, twisted, and even broken to serve the smallest wish at the moment it appears.

This assumption, that there must be no interference with individual or corporate exploitation of land and resources, has been false from its inception 300 years ago. We have been able to live with it for that long only because we had a whole continent to desecrate, and that took time and doing, even for Americans. To the extent of municipal zoning we have even been unfaithful to the false concept itself.

Also past is the time when decisions on land and resource exploitation affecting the lives of thousands for generations to come can be left to an individual balancing cash-in-hand profits against his public conscience. Seldom has an individual conscience weighed heavily enough to triumph in such a contest. Corporations and businesses have off-and-on consciences, controlled by switches labeled profit, expediency, and necessity. They could not be otherwise and survive. But such a conscience does not inspire confidence in the corporate ability to pit expansion against public welfare and decide in favor of the public with any degree of frequency.

The second basic problem, and one even closer to the resource manager's desk, is the necessity for far greater coordination of *all* resource management programs at the state and federal level. If we are going to have the fullest management, the broadest and longest-term use with the least damage, the best development, and the most effective and far-reaching protection for all our resources, we must begin to consolidate. No longer can we afford to have five or six different state agencies all planning land and water use programs of one sort or another without any effort to integrate such plans. The management of water, forests, wildlife, soils and minerals cannot be apportioned as though they bore little or no relation to each other. On both the state and federal levels we must begin integrating and coordinating into single management, use, development, and protection plans the needs of all these agencies. They are already beginning to compete seriously in certain areas. Interagency competition for control of basic resource planning is the last thing which will benefit our state and national conservation programs. Every state and federal acquisition of any type must, from now on, be the result of planning with every resource aspect involved before and not after the fact. Some basic changes are necessary in both the federal administration of resources and in most states if this aim is to be accomplished.

Finally, this must be a public program developed with public funds, and involving perhaps the largest number of disciplines ever used to accomplish any objective. If we are to maintain quality in our resource programs and in our lives, it is essential that such an approach be effective. Perhaps, in the last analysis, the most important single step in this entire program is the education of the public to recognize the true relationships between man and his environment and to support the actions necessary as a result of this recognition. The effectiveness of present and proposed salt marsh preservation efforts will be something of a yardstick by which to measure the extent of public support for a really comprehensive approach to resource management in general.

#### SUMMARY

Salt marshes of coastal North America may be defined in several ways. These include definitions in terms of tidal relationships, physical structure of the marsh itself, and botanical definitions. Of these, botanical definitions are the most accurate and, if upheld by anticipated court action, probably the most useful for protection efforts.

Salt marshes exhibit a wide variety of values and uses in a completely natural state. These uses and values include extremely high

ability to produce nutrients of value to man through complex marine food chains; use by larval fin fish of many species of commercial and recreational value as nursery areas during vital stages of development; resting, feeding, breeding, and shelter sites for many types of waterfowl of prime recreational and aesthetic value; buffer zones between water and land during storms; important recreational uses such as hunting, fishing, shellfishing, and birdwatching; aesthetic and scientific values based on the age and continuity of the vegetative community, open spaces along otherwise overbuilt and over-commercialized shorelines, and potential as natural marine-shore parks.

Except for recreational uses as mentioned above, most of the uses to which salt marshes are being put today either seriously degrade or despoil completely many or all of the natural values of the marsh. These uses include dredging or filling of salt marshes to create marinas, commercial fishing and shipping docks, airports, building sites, and highway locations. Many salt marshes have been removed to reach valuable sand and gravel deposits lying beneath them. Coastal communities tend to locate their municipal and industrial dumps in salt marshes and to use the marshes as spoil dumps for marine dredging operations. Waters adjacent to salt marshes are frequently used (overused) for the dilution of domestic, industrial, and municipal sewage, and raw sewage from marinas may be a prime problem in some areas.

All of the above uses tend toward short-run goals obtained at the expense of the much longer-run values of the marsh in its natural state.

Acreage prices for salt marsh in northeastern United States now vary from 25 dollars to asking prices as high as 1700 dollars per acre with an average probably around 200 dollars per acre. Salt marsh in this area was almost valueless 30 years ago.

Riparian and other rights in salt marsh are vague. Mean high-tide lines are extremely difficult to locate accurately in salt marshes. States depending on the principle of state ownership of all tidelands between mean high tide and the bulkhead line to protect salt marsh from exploitation may find that only small portions of many marshes are controlled by state ownership under such riparian traditions. Property lines within salt marshes are frequently even more vague than riparian rights. Division of jurisdiction over tidal lands and riparian resources has led to problems in Rhode Island. A guaranteed right of fishery to all Rhode Island residents has been helpful in the passage of legislation protecting marshes.

Mosquito control projects in salt marshes are suspected of having

done as much to upset ecological relationships as have all other factors short of outright removal or filling of the marsh. While moderate ditching does not seem to be a serious hazard and may even provide moderate benefits, the effects of aerial and other forms of spraying probably interfere extensively with the ability of the marsh to maintain its high rate of productivity. Impoundment of water in salt marshes to control mosquitos probably reduces significantly the nutrient transfer between the marsh proper and surrounding waters.

After many attempts to exercise control over marsh despoliation through objections at public hearings and through court proceedings, new legislation was found in Rhode Island to be the only effective approach short of outright purchase to permanently protect the marshes. The marsh-protection campaign in Massachusetts and Rhode Island was found to have unprecedented support from the public.

The salt-marsh controversy is another of the increasingly frequent conflicts between traditional owner prerogatives to do whatever he pleases with his own property and the public interest in that same property over extended periods of time. Integrated resource management agencies at the state and federal levels can do much to alleviate the salt marsh problem and many other wasteful programs of resource use at all levels of government. In the final analysis education will be the most potent weapon against poor resource use, but many problems cannot wait for the educational process to take effect and must be solved now by active, aggressive, and imaginative programs of resource use, development, management, and preservation backed by all conservation oriented groups and above all by public funds.

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## DISCUSSION

DISCUSSION LEADER GEORGE: Thank you, Mr. Hawkes. This paper will now be open for discussion.

I believe this paper fits our conference theme particularly well and shows some of the problems of renewing the quality of our resource environment.

MR. JOHN LAVIGNE (American Humane Education Society of Boston): How much has the balance of nature been upset by the dumps as a result of subsequent gull increase? Has the balance of nature been upset to a great extent in marshland? How much has the filling and the dumping been affecting duck and other wildlife breeding?

MR. HAWKES: I don't know whether I can actually give you an answer to these questions.

The Massachusetts Audubon Society and the U.S. Fish and Wildlife Service and other federal agencies cooperated on a gull study recently and found the major reason, as far as they can determine, for increase in gull population in the northeast over the past 25 years or so has been a food supply available all year round due to dumping.

The direct effect of these dumps on waterfowl population has been slight. But these dumping grounds, as they grow, simply destroy the marshland value for waterfowl and everything else involved.

MR. GEORGE: On the gull problem. I don't think it is generally realized what a scavenger the gull can be and when you get thousands of gulls where formerly there were none, then they are going to destroy a lot of nesting birds and eggs.

MR. ALLAN GALBRAITH (New Jersey State School of Conservation): I was very intrigued with your presentation. I was, during the past summer, involved

in a coastal survey of estuary resources. Most of the problems you have outlined for Rhode Island are problems that are more or less encountered in many other states. Many alterations are proceeding at a rate much faster than any of us would like to see in other areas. The closer to urban centers, the greater the intensity of the alterations.

I would like to reinforce with conclusions we reached this summer some of the conclusions reached. Certainly the coordination of the vested interests of management agencies, statewide and interstate, are extremely important. Also important is the question of legal responsibility and ownership of the marshes. This is another critical problem.

It seems to me that there is quite a distinct variation between various state laws. Perhaps most important, as pointed out, is recognition on the part of the public of the value and importance of our estuary resources. It seems to me that the general public still considers marshland wasteland. I would like to compliment you on this fine presentation and still point out that there is a problem involved here.

MR. JAMES SHEPARD (Massachusetts): Our problems in Massachusetts closely parallel those in Rhode Island. I wonder whether or not you have tested the validity of the dredging bill similar to that which we had in Massachusetts. Further, do you feel this device will do the job, the job of protection needed along that line?

MR. HAWKES: Well, I can only give you my personal opinion. This does not necessarily represent the opinion of the State Department of Natural Resources.

In the first place, we have not tested the legislation in Rhode Island mainly because even though it had been on the books for over a year, we have had no action on it on the part of the State Department of Natural Resources.

As to whether or not I consider this to be adequate; no, I do not. I think the inadequacy of it lies in the fact that it will be interpreted in its administration, and in this interpretation there is going to be an attempt to qualify the marshes or really give priority to certain marshlands over others. In Rhode Island we simply cannot afford to do this. We do not have that many left. For this reason I am afraid it is not going to be adequate and I think the only solution ultimately will be to buy all the marshlands. We actually have a program under way under which this will be done.

In New Jersey and some of the larger states, we have enormous amounts of salt marshes which they are looking forward to purchasing under some type of program. I know that in New Jersey they already have some 35,000 acres of marshland. In order to protect it enough to really do the job, they are going to have to develop some sort of legislation which will help but not necessarily solve the problem.

CHAIRMAN JOHNSON: I suspect I have the support of all of you when I say that I am thankful that in Rhode Island we have more Hawkes than doves on this subject. (Applause)

## GADWALL SEEDING IN NEW ENGLAND

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In face of the millions of dollars in public funds that have been spent on waterfowl management during the past 20 years, this is a short and simple story of what private individuals may accomplish in the culture of free-winged ducks on small areas with modest expense. The propagation of ducks for wild management is a subject that has not graced this conference in 30 years; and yet, no group of birds—not forgetting the pheasants—is so amenable to culture as are North American waterfowl. We believe that, before long, there will be large-scale husbandry of wild ducks and geese on private lands. Such management will not only add materially to the numbers of birds on the wing in many regions, but it will also provide safe congregating and resting areas for migrants. With the evident pressure to liberalize public shooting on our national and state wildlife refuges, and with the inevitable burning-out of both their local and migrant ducks, private lakes and marshes are of growing importance to the welfare of waterfowl. And while these reserves are providing safe places of rest, the owners (whether private individuals, or communities) will also enjoy wildfowl in their midst. Let us not forget, while we are on this subject, that the results of cooperative waterfowl surveys, prepared by the U. S. Fish and Wildlife Service, indicate that less than 2 per cent of the breeding ducks of the Prairie States and Provinces nest on public lands. The balance breed on farms and other private holdings. Waterfowl management is much more of a private adventure than most people realize.

Wild duck culture requires a shallow pond or lake, with some upland meadow for nesting of dabbling ducks within control of the owner. There should be some marshy shoreline, escape cover of ducklings and for nesting diving ducks, but such is not entirely necessary to success. Artificial nesting baskets, or boxes which are predator-proof, may be used in lieu of natural shoreline cover, and small islands serve to protect broods. Shelter from prevailing winds, as a bank of trees, enhances a wildfowl pond. But, it is not our purpose here to go into characteristics of good range. Ducks are broadly adaptable and, if encouraged by food and protection, will thrive and reproduce under conditions quite unlike those of their

favored wild breeding places. And too much emphasis has been given to the importance of latitude in waterfowl reproduction. True, most ducks now breed in the North; but, in pristine times, all species of game ducks bred as far south as the 38th Parallel—below the Nebraska line. Even today, in times of scarcity in the North, there are several important nesting ranges far south of the main breeding range as the Cheyenne Bottoms, Kansas, where there is a strong colony of nesting redheads.<sup>1</sup> It is worth noting that the only regular artificial propagation of canvasback now takes place within the City of Los Angeles. Undoubtedly, every species of wild duck may be induced to breed in the majority of the States of the Union!

There are three types of artificial culture of waterfowl: the display collection, the game farm, and the free-winged reserve. The display collection is usually of pinioned birds held for pleasure in yards and on small estates and, of course, for educational purposes, in zoological gardens. Hand-reared captives breed readily in domestic situations. The young are usually sold or traded to maintain the cost and the strength of the flock. The general practice is to have one, or only a few pairs, of a given species, the flocks being made up of several kinds of ducks. Private collections of waterfowl are popular in Great Britain, thriving not only on country estates, but often on small ponds within the limits of large cities.

Game farms and shooting preserves produce hand-reared ducks—always the mallard in North America—for controlled gunning on private shooting grounds. Although the shooting is highly artificial, such production may be important in removing some pressure from wild flocks. Moreover, there is a small but continual escape of birds, which, in some instance, have been the nucleus for local wild breeding populations. New York State has raised species other than mallard on its game farms, notably pintail and redhead. These birds have been produced for experiments in seeding a different species on a new breeding range. The New York Conservation Department has successfully established the redhead in New York on a limited and local scale; and “evidence indicates that most of the present breeding population of mallards in New York is the product of stocking since 1934” (Foley *et al*; 1961).

The free-winged reserve aims at the culture of full-winged waterfowl that may come and go at will. Waterfowl reserves are also established for the pleasure of the owner. Any farm, estate or park is enhanced by free-winged waterfowl; and, of course, such local populations have a great potential for experimental pur-

<sup>1</sup>This evidence is carried in the Special Scientific Reports on Waterfowl Populations and Breeding Conditions, which have been issued by the U.S. Fish and Wildlife Service each year since 1947.



poses aimed at yielding greater knowledge of waterfowl management techniques. It is such a reserve for ducks that is the main topic of this paper, an experiment with gadwall being used as evidence. The free-winged reserve employs food, water and protection as "bait" to hold birds on a given range. But simply supplying these does not assure a flock of ducks. Some birds, may stop by in spring and fall and, in due course, a pair or two will settle to breed. But the most satisfactory way to establish a local population is by introducing hand-reared breeders to the reserve. There are four ways in which this may be done: 1) with proven adult breeding pairs; 2) with pinioned young which will breed as yearlings; 3) with free-winged young; 4) with free-winged adults.

The use of adult breeders which have bred in captivity elsewhere is the most expensive and least satisfactory method of building a local population. The idea is to obtain, by trade or purchase, a pair of known breeders, then let these rear their young, which are then allowed their freedom. But, proven breeders, of even the most common species, sell for as much as \$50 to \$75 a pair; and they may be upset by moving, passing one or several nesting seasons without reproduction on new range. These birds must be pinioned; otherwise they will depart in search of their old home. Indeed, if they are not held behind wire at first, they will sometimes walk off in response to their instinct to return home.

Hand-reared young of all North American ducks will breed in captivity and, in most species, their first spring. Such birds, pinioned as downy young, will breed successfully on a range to which they are introduced as juveniles. This is the safest and cheapest technique for introducing a local flock. It is safe and inexpensive because the breeding stock will not wander away to suffer hunting losses. Also, the breeders are productive every year, with a life span of 12, or more, reproductive seasons. On small ranges, however, this technique may be restrictive because of territorial strife amongst pinioned breeders. They are unable to spread out as broadly as flying birds, hence there may be more fighting among the males, more harassment, rapes and killings of the females, with reduced reproduction. This can be avoided by holding the breeders in pens and, in some species, by inducing polygamy. Thus, in the mallard, one drake will serve six to ten females in a breeding pen. The greatest return, from this type of rearing, is with artificial incubation, each hen robbed on her first two clutches for the incubator, then allowed to hatch and rear her third clutch. Much depends upon the interest and funds available. For those who wish to build a completely free population, the holding over of pinioned birds is an awkward incon-

venience after the flock has become established. This, of course, can be avoided by clipping a wing rather than resorting to permanent pionioning. Then, after one, or several flightless breeding seasons, their primary feathers are allowed to grow, and they may come and go freely with their progeny.

The free release of juveniles is theoretically the cheapest and most satisfactory pattern for seeding a local population. The birds grow up to learn their rearing locality as "home," no matter where they are hatched, as long as they are set free there before their first flights. In short, a duck knows the place where it learned to fly as home. Such birds migrate according to the pattern of wild birds; and in spring, at least, the females return to the home pond or its vicinity to breed. A significant drawback is the heavier-than-normal first-year mortality to guns. This excess loss of hand-reared juveniles is apparently greatest in the North, especially where birds are released on or near shooting grounds. Where the place of release has a large buffer area protected from gunning, first-year mortality is lessened, according to our experience at Delta. The ideal situation would be a protected marsh in an area far enough south that some open water remained until late fall or early winter, so that the birds were not pushed out to the gun by early ice. Boyd (1954), in a study of hand-reared mallards in England, concluded that high mortality was due to sedentary habits; "reared for shooting, they get shot; reared with protection they survive exceptionally well." Hunt *et al.* (1958) reached the same conclusion in a study of hand-reared mallards in Wisconsin. Hand-reared gadwall are not as sedentary as mallards. But these studies of the mallard point to the importance of protection on the place hand-reared ducks are released.

A modification of this direct release of juveniles is to hold them over their first winter, free-winged, out under wire. These birds escape the hazards of the first fall shooting season; and, other than winter pen losses, they are there in full strength when the breeding season arrives. Our experience at Concord indicates that it is relatively easy to construct a covered pen and maintain open water for full-winged ducks to be overwintered. Then birds are given their freedom at spring breakup, or when spring flights arrive from the South. And even though these duck reserves may attract migrants, wintered-over birds will not depart with these travelers when the latter move on. Instead, they embark on courting flights and set up territory, in the vicinity of their winter home.

If a covered pen is not available, the primary feathers of one wing of juveniles may be clipped in late summer after they are brought to a new range. They are flightless all fall and winter.

Three or four weeks before the spring breeding season, the quills of the clipped wing feathers are gently pulled from the wing of each bird. New flight feathers will then grow in, and the birds are flying for the nesting season. There is little doubt that flightlessness inhibits reproduction to some degree, hence it is important to pull the clipped stubs in time for the birds to range freely soon after the spring breakup. Quills should not be pulled too early, however, when there is still danger of heavy frost, or else the new-grown, blood-filled feathers may be injured.

We have established the gadwall as a breeding species at Concord, Massachusetts. And, although the results are small, and the study still being carried forward, there have been so many inquiries about this "seeding" that we make this report in progress. The birds involved were hand-reared gadwall, hatched and captive-reared at Delta, Manitoba, the eggs having been taken from nests of captive birds held at the Delta Waterfowl Research Station under the direction of Peter Ward. The first seeding was of 24 juvenile gadwall (12 of each sex), shipped to Concord as three-quarter-grown young, August 2, 1957. In late August and early September, 1957, they were released to Great Meadows Ponds, one mile from Concord Center, on a private reserve of 45 acres of water in two lobes, and 25 acres of meadow and woods. The pond is bordered on one side by suburban housing and on the other by the Great Meadows National Wildlife Refuge. Richard Borden has lived beside these ponds since 1952 and has never seen or heard of free-winged gadwall there before 1957. Gadwall were seen on the ponds in 1958, however, and again in the spring of 1959 and 1960. The first evidence of wild reproduction was in 1961, when a brood of nine gadwall fledged on the pond. Another brood of 7 reached maturity there in 1962. In 1963, adult gadwall were observed on the ponds in April and May, and their spring behavior suggested that they were settled as breeders; but no nests or broods were actually seen. Again in 1964, two pairs of gadwall, revealing their reproductive status through courtship, territorial behavior and three-bird chases, became established on the ponds. The nest of one of these pairs was found after it had been destroyed by a predator, but no broods were seen.

However thin this line of descent, it is clear that the small release of full-winged juvenile gadwall in 1957 established this species on Great Meadows Ponds as a breeding resident with some productive success over a period of seven years. It was decided to strengthen this "lead"<sup>2</sup> by introducing new blood, this time over-

<sup>2</sup>We use the term "lead" in the meaning given it by Dutch decoymen: "A group of experienced birds which have been induced to react to a given pond as their home."

wintering 60 gadwall and holding them for spring release. Thus, in 1965 we released 52 hand-reared Delta birds on April 9 (23 females, 29 drakes—the disparity due to winter escapes and 4 deaths in the pen). Seven pairs established themselves on Great Meadows Ponds, producing six broods, three of 6, one of 7, one of 8, and one of 10. The remainder of the 1965 release, at least 14 pairs, spread out from Great Meadows Ponds and were observed up to five miles from Concord. Two or three breeding pairs were observed during the spring in the Great Meadows National Wildlife Refuge. Reproduction of this group is unknown, but at least three pairs established home ranges beyond the limits of Great Meadows Ponds. By the end of the summer, up to 50 full-winged gadwall were using Great Meadows Ponds. It is difficult at this stage of development to differentiate between full-fledged birds of the year and adults, but we had a very encouraging local gadwall flock on the wing in the ponds regularly until November 20, when the last birds departed in autumn migration.<sup>3</sup>

Great Meadows Ponds are 70 acres in extent; hence seven breeding pairs equaled one pair per 10 acres. This amounts to about 64 pairs per square mile on a broad basis, a much greater density than is found over most of the prairie breeding range. In Saskatchewan and Manitoba, for instance, pair counts in 1952 (a good season for waterfowl reproduction) showed 1.2 to 2.0 pairs of gadwall per square mile (Dzubin, 1952; Gollop, 1952; Keil, 1952; Stoudt, 1952). By artificial culture in a new setting we have established a population density greater than is found on much of the natural prairie range of this species. There is evidence, however, that the gadwall responds well to management. Leitch (1954) found 4.2 to 14.8 pairs of gadwall per square mile on 4.25 square miles of the Caron Potholes region of Alberta, 1950 through 1954. Hammond and Mann (1956) found 200 gadwall nests per acre on islands of the Lower Souris Refuge in North Dakota. Deubert, also studying these Lower Souris concentrations, counted 450 breeding pairs of gadwall on the 3,600 acres in 1956, about 80 pairs per square mile. On the Ogden Bay Refuge, in Northern Utah, Gates found 40 pairs of breeding gadwall settled on his study area of 450 acres, about 58 pairs per square mile. This evidence of high breeding densities of gadwall on controlled areas suggests that this species may be highly susceptible to management on free-winged reserves.

<sup>3</sup>Borden noted a pair of gadwall on Great Meadows Ponds on March 20, 1966. On March 30, he saw three drake and two hen gadwall there. The females were both banded, but at least two of the drakes were unmarked, suggesting that the hand-reared females had brought "outside" drakes back to Concord with them. One of these pairs had established territory on Great Meadows Ponds by April 27. Another hen was using the pond but had no hen attending her. As of May 30, three distinct pairs were nesting actively there.

Borden, was impressed by the absence of overt strife in the Concord birds; they established their home ranges with little fighting. This may have resulted from their long pen association; the Concord gadwall may have been prepared to adjust to their home ranges more peaceably than in the wild. We have evidence of the influence of pen relationships at Delta in mallard, pintail, and blue-winged teal. Birds over-wintered for spring release establish local breeding densities higher than have been observed elsewhere in Manitoba. Of course, we must not forget that in the spring release of over-wintered breeders, we may be saturating a range in a manner seldom possible in an entirely natural situation due to the heavy fall and winter mortality of birds in the wild. Surely, by studying the behavior of over-wintered birds, we can learn a great deal about the management of breeding waterfowl. Our aim in waterfowl management must be not simply to seek ever more birds from the north, but to produce more per square mile on the reduced but still prime range of agricultural and urban areas of middle latitudes. Thus, besides rewarding any landowner who wishes to make his pond a place for ducks, seeding must be considered also as an important pattern of research toward understanding more about the management of wild duck populations.

The range of the Canada goose has been materially enlarged by plantings, not only on public areas but on private reserves. Because of the different social structure of the family, the planting of ducks has not been thoroughly understood, and experiments have been thwarted by the extremely heavy first-year gunning mortality. But, as interest in local duck culture enlarges, and especially, as we come to understand that the north country cannot be the everlasting source of wildfowl, we should look to other solutions. The establishment, or re-establishment, of free-winged populations of gadwall and other North American ducks on range now vacant of breeders must surely advance as a research and management technique.

There is one more point that our seeding experiments at Delta and at Concord have brought to light. This concerns the decoy value of a band of local residents. It involves a simple truth, which many seem to have forgotten: only ducks beget ducks! Reading some current releases on waterfowl conditions, one cannot help but wonder if some of the authors do not truly believe that water, per se, has some genetic qualities which, with its return after drought, somehow causes the immediate return of waterfowl! Of course, this is not so! Especially in our present situation—where we have failed to “stock-pile” ducks over the dry years—so that old birds would be ready immediately, to take advantage of the return of water to sloughs

and potholes. Instead, our mature breeding stock is low and young birds, hatched during the drought, must pioneer their way to new ranges when water returns. Seeding may be a technique for speeding the recovery of local breeding populations. Only ducks can produce more ducks; hence a seeded area will quickly establish a "lead" of experienced birds. More than this, such leads attract other ducks so that, on any underpopulated range, the largest populations, spring and fall, will first be found in company with stable, established breeders. Thus, for the past three lean duck-years, the largest single flock of autumn ducks on the 36,000-acre Delta Marsh has been on the flight pond of 8 acres at the Delta Waterfowl Research Station. In spring, the high concentration of breeders there appears to attract some travelers, so that local breeding densities are held high, not simply by our releases, but by unrelated birds attracted to this center of waterfowl activity. Borden's experience at Concord is similar. Although the gadwall is so rare on the East Coast that it is unreasonable to expect more gadwall to be immediately attracted, there was, nevertheless, a notable increase of ducks of other species in the fall of 1965. Without any feeding beyond the pens, up to 500 or 600 ducks are fall visitors to Borden's 45 acres of water. Thus a seeded pond grows, on a seasonal basis, not simply by the mathematical increases of reproduction, but also by an enlarging population of unrelated birds which stop by to partake of "a good thing."

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## DISCUSSION

CHAIRMAN JOHNSON: I see that the co-author of this paper, Mr. Hochbaum, is present and I wonder if he would care to make any supplemental comments?

DR. H. ALBERT HOCHBAUM: I would like to add one or two points to the discussion given here.

Those of us who were at the Mississippi Flyway Council meeting yesterday heard how we are planning to divide up what is left of waterfowl and of what little there is being done toward producing more waterfowl. I think it is worth noting, in connection with the long road back for waterfowl, how private people are working and experimenting with the problems of restoration. This is a difficult and misunderstood problem, especially in terms of breeding population densities. The waterfowl survey reports indicate that on the prairie pothole range as a whole, in good years, as 1952, there are about two pairs of Gadwall per square mile. But on managed areas, much higher breeding densities are found. We must learn how to induce higher densities elsewhere, for one problem in waterfowl management is that of producing more ducks on less ground.

We chose the gadwall because it may be bred and handled in captivity as easily as the mallard, and, further, with this species hand-reared birds do not become contaminated with domestic blood as in the mallard.

MR. GEORGE: Thank you very much. This paper has raised many questions in my mind, as well as yours I am sure. In reality, it is amazing that we have not had a paper on this subject now for some thirty-odd years. I believe, from checking the records, that this subject was discussed at our first conference, some 31 years ago.

This paper is now open for discussion.

MR. K. L. SATHER (Round Lake, Minnesota): I would like to know if this project was done through private effort.

I might add that at Round Lake, Minnesota, ten farmers who control the hunting of several sections of a joint property, have banded together to produce more game on their land. They have flocks of one hundred breeding giant Canada geese, the first in over sixty years apparently, and within six years this group of farmers will have been breeding canvasbacks on Heron Lake, using the plan similar to the gadwall plan. I merely offer that as a comment.

MR. E. T. ROSE (Iowa Conservation Commission): I must, I feel, as Chairman of the Mississippi Flyway Council, take exception to Mr. Hochbaum's comment concerning lack of concern for conservation of waterfowl in the Mississippi Flyway. Our Council has underwritten a program for research in connection with Canada geese which amounts to many, many thousands of dollars before it can be consummated. We are hoping to increase the population of one particular flock, the Mississippi Valley Flock, from 300,000 to 400,000. This is one example of the concern that our Flyway has for the future of waterfowl.

Many of the states in the Mississippi Flyway Council have gone to considerable expense trying to do exactly what this paper is proposing to do—to develop resident flocks of mallards—but which met with nothing but failure. I am also sure that the literature is replete with similar instances.

If there is anything that the Mississippi Flyway Council can do for other flyway councils to preserve and increase the populations of waterfowl, certainly it is our obligation and desire to do so.

MR. HOCHBAUM: I would like to make one comment in relation to what Mr.

Rose has just said. He spoke about the Canada goose, which is quite different from the ducks. I would like to say that I am from the Province of Manitoba and we are truly, in my part of the Basin, growing into a "have not" area.— The average bag has been reduced to less than two birds per man per day. The largest flock of ducks, 2,000 mallards, was confined to privately managed marsh.

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## HISTORICAL AND ECOLOGICAL FACTORS IN WETLAND INVENTORY

W. G. LEITCH

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In a recent paper (1963), J. Bernard Gollop of the Canadian Wildlife Service reviewed the wetland inventories completed and presently underway in prairie Canada; specifically, those of the U.S. Fish and Wildlife Service (Lynch *et al.*), Rose and Morgan and Ducks Unlimited (Canada). This paper provides additional data on the Ducks Unlimited program, which may be useful to other organizations working with prairie wetlands.

Although it might appear that three wetland inventories are being made of the same area, each has different objectives for which specific techniques were developed. As a result, they are complementary rather than duplicative.

Lynch (1963) described his survey as "an extensive-intensive appraisal of prairie waterfowl environments . . . designed to catalogue them and map their location and extent." Rose and Morgan (1964) stated their objective as "to determine where duck breeding habitat is threatened by agriculture and how it may be preserved or acquired." The Ducks Unlimited program has the same general objective as that of Rose and Morgan but deals with individual water areas rather than with broad regions and is oriented to an action program involving preservation, construction, and development. At this level, historical and ecological factors become important in wetland classification for waterfowl.

Although considerable prior data has been gathered on individual wetlands in connection with engineering developments, it was in 1954 that a systematic wetland inventory became part of the Ducks Unlimited program on the Saskatchewan prairies.

This was a period of high water levels and severe flooding of peripheral croplands. A series of previous dry years had permitted farmers to encroach on many wetland areas. Subsequent reflooding of this accrued land led to demands for drainage in spite of the fact that in many instances most of the land involved was public. Little of the waterfowl history of these areas was known, and what



could be gathered in the last desperate days before the draglines began to dig was too little and too late to build a case to avert drainage. It was to establish the waterfowl values of these areas prior to such an emergency and to justify their continued existence as wetlands that the inventory was begun.

The inventory was originally organized on a topographic map sheet basis, each of which, at a scale of 4 miles to the inch, covers approximately 172 townships or 6,660 square miles. Larger wetlands, those in excess of 640 acres, were first concentrated upon because this class was most seriously threatened due to government assistance for survey and drainage. Smaller areas were included when convenient or where they were endangered. At this stage no attempt was made to cover all the wetlands on a map sheet. Reports were made on each wetland inspected and an interim summary report prepared for each map sheet when all the large areas had been covered. These were made available to the appropriate wildlife authorities. The original intention was to inventory the smaller areas at a later date and prepare a final complete report which would include all the wetlands of significant value to waterfowl. Drought and a change in agricultural drainage pressure to more northerly areas altered this plan and forced a shifting of emphasis northward.

As the program moved northward, it became apparent that if development and management were to be the logical outcome of the inventory, then the best approach would be on a watershed basis. This provides much greater latitude in planning for water management and promotes the philosophy of multipurpose watershed development rather than unorganized drainage. The watershed thus became the unit of inventory. To develop this more sophisticated technique, all water areas in excess of 50 acres were included in the coverage.

Since 1954, individual inspections have been made of 1,288 areas in Saskatchewan and summary reports prepared on 15 topographic sheets and 6 watersheds—a total of 102,199 square miles. These data have been made available to the provincial wildlife branch to use as they decide best in the continuing struggle to preserve waterfowl habitat.

In Manitoba a special survey was made of the wetlands of the Interlake area in excess of 200 acres. Due to previous ground experience and because this habitat block shows small annual variation, it was possible to do this survey from air. A total of 241 wetlands were thus inspected and reported upon and a summary report prepared. As a result, the Manitoba Wildlife Branch was able to place reservations on 61 of the better areas totaling 128,405 acres. A similar aerial coverage was made of the Westlake area where 64 wetlands were inven-

toried. These data were all made available to the Canadian Wildlife Service for inclusion in the Canadian Land Capability Classification for Wildlife, conducted Canada-wide under the administration of the Agricultural Rehabilitation and Development Act. The ground program in Manitoba has been reactivated, and 54 wetlands were reported upon in 1965.

Immediately we began to classify wetlands on the basis of waterfowl productivity, it became apparent that the water history of each area was of paramount importance. Prairie waters are characteristically changeful and deceptive both on an annual and long-term basis, and classification based on existing vegetation without reference to historical factors can be very much in error. The classification of U.S. wetlands of Shaw and Fredine (1956) has this weakness, which makes it unsuitable for prairie use. For example, the same water body may be put correctly into several different classes depending upon conditions at the time of observation.

We found the classification for North Dakota proposed by Bach (1951) best suited our purpose, designed as it was for the arid prairies where the longevity of a water area is of prime importance.

Lynch (1963) was critical of ". . . the philosophy that 'the Permanent' is somehow a desideratum." In fertile prairie watersheds we believe it is, and that the degree of departure from permanency is a valid basis for classification of prairie waters from a waterfowl standpoint. In wet periods there is abundant water everywhere, but in dry years only the more stable waters, those with larger drainage areas or on well-defined streams, provide waterfowl breeding habitat.

These semi-permanent areas are the nuclei of production. They provide brood sloughs, without which the transitory spring waters would be non-productive in many years; breeding habitat during prairie droughts, when it is in shortest supply; and maintain a reserve of breeding birds to take advantage of the "dynamitic" (to use Lynch's expression) qualities of the prairie potholes when they refill.

An acquisition program which did not give considerable weight to the permanence factor in selecting units for acquisition would be shortsighted indeed.

Bach's classification for North Dakota wetlands was described in a paper given at the Midwest Wildlife Conference in 1951. Briefly, he divided prairie wetlands into descending classes of permanency lettered from A, permanent waters, to D, the most transitory. For our purpose we found it worth while to divide his B Class (which he defined as those areas which normally hold water all year except in severe droughts) into Subclasses Ba and Bb. The Ba areas are those of high permanency. They were dry in the drought of the 1930's

but not in the dry years of 1946 or 1949. Bb areas were dry both in the 1930's and in 1946 and/or 1949, and are regarded as of medium permanency. Recently we have added 1961 as another guide year and will probably have to revise all our standards to more recent drought guideposts.

Farther north, we found a different water regime and had to modify the Bach C classification to suit. On the prairies this category is used for low permanency water areas which are normally dry by July or August. In the northern parklands another water condition exists where such areas may be wet or dry for several consecutive years. We used a Cb classification for the prairie condition (Bach) and a Ca for parkland conditions described above.

The need for a Ca classification arises because the watersheds of some of the larger northern wetlands contain relatively large amounts of dead storage. In years of light or moderate runoff the water is caught in these small depressions and never reaches the larger areas. In this way there may be abundant water in the small wetlands of the watershed even though larger areas are relatively dry. Above normal runoff for several years is required to fill the smaller depressions completely at which time the watershed becomes active and the larger wetlands are quickly filled, often to considerable depth. When dry conditions return these areas often persist for several years without replenishment although the remainder of the watershed may be dry.

These historical data, which we consider essential to understanding and evaluating prairie habitat, usually can be obtained only by interview of local residents. Aerial photographs can also be used if a series is available which covers both wet and dry years. Traces of the aquatic habitat are a poor guide for, to quote Gollop, "Water appears and disappears so rapidly and unpredictably that aquatic vegetation while an indication of the immediate past may be misleading with regard to the long-term past or average which in turn might serve as an indication of future prospects." In the last five years we have seen good Bb type ponds (those of medium permanency) travel the full cycle from good muskrat habitat to cultivated fields with no trace of aquatic vegetation and in 1965 reappear as transitory C areas.

Having established the permanency category of the wetland, the next step was to rate it from a waterfowl productivity standpoint. To do this we gathered the physical and biological data as outlined in Figures 1 and 2. From these the area was rated 1 to 4 on a descending scale of estimated waterfowl productivity.

Figure 1.

*DUCKS UNLIMITED (CANADA)*  
*REPORT FORM*  
*WETLAND INVENTORY*

Name	File #	Eng. #	Classification
Sec.	Twp.	Rge.	W
Direction & distance from nearest town			
Observer	Date		
Contact			

*Physical*

Number of acres		Miles of shoreline	
Depth in feet		Maximum	Average
Present level in relation to F.S.L.			
Area at F.S.L.	Acres	Shoreline at F.S.L.	Miles
Source of water			
Profile	Shore	Bottom	Contour
Shore and bottom type			
Turbidity	Salinity		
Analysis			
Adjacent water areas			
Local topography			

*Biological*

Submergents  
Emergents  
Shoreline and upland vegetation  
Waterfowl use  
Muskrats and other wildlife use

*Historical*

Water levels  
Land use (include present use)  
Marsh  
Uplands

*Public Relations*

Ownership  
Crop damage  
Recreational value  
Public opinion and future disposition

*Limiting Factors**Proposed Improvements*

Figure 2

*INSTRUCTIONS*  
*WETLAND INVENTORY*  
*REPORT FORM*

NAME	—Give local name for area and map name, if named.
FILE NUMBER	—Based on National Topographic Map. Series—72H etc. and assigned in chronological order—72H-1 etcetera.
CLASSIFICATION	—Based on permanency and to follow a revised Bach system. Waterfowl rating based on potential production in a given soil zone—1—excellent, 2—good, 3—fair, 4—poor. Soil zone in which the area is located to be designated by the soil zone number used as a prefix—e.g. 2A1, 3B <sub>a</sub> 2.
LOCATION	—Section, township, range and meridian—relation to nearest town (10 S.W. of Roleau).

## HISTORICAL AND ECOLOGICAL FACTORS IN WETLAND INVENTORY 93

- OBSERVER —Individual making the report. (record date)
- CONTACT —Person who gave history or acted as guide. Someone who can be contacted for further information, etcetera. Include address.

### PHYSICAL

- Acres —of water at time of inspection.
- Shoreline —estimate length in miles at time of inspection.
- Depth —Maximum (note if measured or estimated). At least one depth shot should be situated so that it can be easily relocated for subsequent measurement.
- Present level in relation to F.S.L. —F.S.L. defined as natural outlet or highest previous shoreline, beach, treeline, etcetera. Add in report criterion used as F.S.L. Tie water level into culvert or other object which can be readily relocated.
- Water source —Local or stream fed. Add descriptive sentence if necessary.
- Profile —Categorize as steep, medium or flat, *includes* bottom of water area.
- Contour —Shoreline shape—Categorize as regular, somewhat irregular, irregular—*Note* number of islands (3 small islands, 1 large island, 2 small, etcetera).
- Turbidity —Express light penetration in inches or to bottom in shallow area.
- Salinity —Categorize as—fresh, saline, extremely saline. Take water sample for later analysis.
- Adjacent water areas —Within a mile of shoreline of area—describe in short sentence e.g. "Many small semi-permanent water areas."

### BIOLOGICAL

- Submergents —Give species and categorize as some or abundant. Either of the last two categories to be used with each species listed.
- Emergents —Give species and percent of area covered and if confined to periphery or widespread.
- Shoreline & Upland Veg. —Short descriptive sentence giving type, amount, etcetera.
- Waterfowl use —Short descriptive sentence giving value to spring and fall migrants, production and moulting. Give species composition percentage in order of abundance and estimate total number of waterfowl using area at time of inspection.
- Other Wildlife use —Muskrats, fish, gulls, etc., mention if breeding or transient.

### HISTORICAL

- Water Levels —Give specific years in which area has been dry.
- Land Use —Past, present and future, include both marsh and uplands, a short descriptive sentence, including specific dates of significant occurrences.

## PUBLIC RELATIONS

Ownership	—Private, Indian, Crown (both marsh and immediate uplands).
Crop damage	—History of damage in the area—frequency and extent.
Recreational Value	—Hunting, fishing, boating, picnicking.
Public Opinion	—Opinion of district re lake—to be preserved, drained, dammed, etc.,—any plans re above.

## LIMITING FACTORS ON WATERFOWL PRODUCTION

Physical and biological.

*PROPOSED IMPROVEMENTS*

Discussion of limiting factors and suggestions for improvement.

*SKETCH*

Show vegetation outlets and inlets, et cetera.

In appraising habitat of such annual variability the problem immediately arises as to what water level the waterfowl productivity categorization should apply. At the time of inspection the area might be dry but may have been productive 8 out of the last 10 years or perhaps well filled after being dry for years. Our decision was to base the evaluation on what we considered as the best water level. This required further reference to the history of the area as well as insight on the part of the field man. This same problem arises annually. All wetland inventory cannot be done in the spring and early summer. In fact, much is done in the fall when time is available and traveling conditions best. An experienced field man is usually able to extrapolate to the spring conditions. Spring breeding counts on representative areas are used as checks and to broaden the experience of field men working on the program.

It is not too difficult to separate the very good areas (Class 1) from those which are of no value at all (Class 4). But classes 2 and 3 constitute a grey zone where the differences between observers appear. Increasing the number of categories only compounds these differences. Presence or absence of emergent vegetation and food plants, availability of nesting cover, surrounding water areas, and shape of the water basin are all important. The final resolution of these ecological factors to a production category is inevitably subjective. We need quick, easily applied objective techniques for evaluating each habitat factor and determining the ecological result in terms of waterfowl values. Research presently underway at the Northern Prairie Wildlife Research Center at Jamestown, North Dakota (Robert E. Stewart, pers. comm.), and in Canada by J. B. Millar of the Canadian Wildlife Service, promises to provide these techniques.

At the present time such precise measurements of habitat as do exist are impractical for use in wetland inventory, where time is such an important factor. It would appear that, for some time to come, the evaluation of individual waterfowl areas will, in the final analysis, be based on subjective integration of historical and ecological factors.

A further refinement in waterfowl production ratings was required due to the ecological zonation of the Prairie Provinces. Increasing moisture efficiency from south to north results in successive change from open prairie to parkland to mixed forest. With comparable water conditions, waterfowl use of the wetlands associated with each of these vegetative zones varies with the zone, being considerably higher in the prairie area and decreasing northward. The best area in the mixed forest would thus be rated well down in relation to a prairie area. Although this confirms what we already know, namely, that given water the prairies provide the most productive waterfowl habitat, without further refinement it fails to give a usable prairie-wide classification of waterfowl habitat. Fortunately the soil zones of the provinces are well mapped and correspond closely to those of the vegetation. Using the soil zone number as a prefix to the classification immediately locates the water area ecologically and establishes the productivity rating relative to other water areas in the same zone.

Our classification, based on historical and ecological factors, has come into common usage within our organization. Such classification as 3Ba2 simply tells us that the wetland referred to is in the black soil zone, is of high permanency but has been dry and for that zone is a highly productive waterfowl area though not the best. Nord (1951) developed what he called a Chain Type Wetland Classification which, in addition to permanence, codified size, amount and dispersion of emergents, et cetera. Such data from our survey were put on punch cards and can be produced on a map sheet, watershed or soil zone basis.

The production factor in this classification might also be thought of as the capability factor. By combining permanency with capability, as this classification does, one can determine the usability or actual long-term value of an area. This is important when alternative uses for a wetland are under consideration. When usability drops much below the capability factor then the need, or possibility, for development becomes apparent.

Agriculture is still young in western Canada and many of the people interviewed at the beginning of the program were the first to break the sod. Discussions with them confirmed what was inferred from the journals of early travelers, that aspen parkland and mixed

forest has encroached on what was originally open prairie. This encroachment was fostered by the elimination of the buffalo, the control of fires, or perhaps a change in climate and has resulted in a down-grading of waterfowl habitat that may be more important than has been realized. Over a considerable area, what were once prairie wetlands are now completely dominated by aspen and willow.

During the drought of the 1960's, evaporation eliminated any excess surface water on the prairies and ended any need for drainage programs there. Ironically enough, during this period, a government-sponsored program provided trucks to fill farm dugouts from the natural sloughs which remained. Many of these would have been drained 10 years earlier had it been possible.

Drainage activities have now shifted to the northern fringe of agriculture. Here permanent marshes are threatened with drainage for hay production. The wetland inventory staff has been increased and the program revitalized to cope with this situation.

Frequently the problem is one of spring or late-summer flooding, which prevents harvest of the wild hay crop along the marsh edge. At this early stage of agricultural development, farmers are usually satisfied if flood waters are removed quickly, and often this can be done by cleaning, enlarging or straightening the outlet channel without lowering the natural level of the marsh.

In other situations, by means of water-level control structures, spring levels may be maintained or even increased, providing greater space for breeding pairs. A limited early summer drawdown for late summer haying affects only the marsh periphery and maintains good brood conditions in the central marsh. The wetland inventory will locate and classify all important marshes on this northern fringe of agriculture and assemble the data on which to integrate the objectives of agriculture and waterfowl habitat preservation.

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## THE INDUSTRIAL STATUS OF LEAD SHOT SUBSTITUTES

J. G. BAKER

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The Winchester-Western Division of Olin is not a newcomer to the field of conservation activities; for over 20 years, we have had very active programs to develop ammunition which would reduce crippling losses in waterfowl and studies to find an effective substitute for lead shot.

I will not insult your intelligence by inferring that the impetus for this work has been a device to simply engage in philanthropic programs. We are businessmen engaged in running a profit-making organization; and very clearly, it is in our interest, as well as that of the American sportsman, to assist in efforts to conserve wildlife, to intelligently regulate the game harvest, and in short, to increase the game base which the sportsman can enjoy.

The search for lead shot substitutes is not new. For many years, ballistic engineers have been engrossed in an intensive search for a practical substitute for lead shot; but to date, results of this effort have been unrewarding.

Until recently, any shot substitute had to meet five basic requirements; to this list has now been added the requirement for low toxicity on ingestion by the dabbling duck, as shown in Table 1:

Of the myriad of materials tested in evaluating lead substitutes,

TABLE 1

### IDEAL SHOT PROPERTY REQUIREMENTS

- |                     |  |
|---------------------|--|
| 1. HIGH DENSITY     | - FOR VELOCITY AND ENERGY RETENTION AND LOAD WEIGHT EFFECTIVENESS.             |
| 2. REASONABLE COST  | - OF BASE MATERIAL.  |
| 3. EASILY PROCESSED | - FOR LOW FABRICATING COST AND REDUCED FACILITY REQUIREMENTS.                  |
| 4. RELATIVELY INERT | - NOT REACTIVE TO OTHER AMMUNITION COMPONENTS AND NON-CORROSIVE IN SHELF LIFE. |
| 5. SOFT SURFACE     | - MUST NOT DAMAGE GUN BARRELS NOR DEFORM CHOKES.                               |
| 6. NON-TOXIC        | - MUST NOT POISON THE DABBING DUCK NOR CONTAMINATE THE MEAT.                   |

TABLE 2

COMPARISON OF CANDIDATE SHOT MATERIALS

	Density lb./cu. in.	Cost - \$/lb.	Processability	Compatibility	Corrosion Resistance	Toxicity	Abrasiveness	Ratio - Shot wt. to Lead	Max. Load 12 Ga. 2-3/4"
1. GOLD	.70	510.00	GOOD	GOOD	GOOD	GOOD	GOOD	1.71	2.6 OZ.
2. LEAD	.41	0.16	GOOD	GOOD	GOOD	POOR	GOOD	1.00	1.5
3. SILVER	.38	19.00	GOOD	GOOD	GOOD	GOOD	GOOD	0.93	1.4
4. COPPER	.32	0.43	GOOD	GOOD	GOOD	?	GOOD	0.77	1.2
5. IRON-PURE	.28	0.41	POOR	GOOD	POOR	GOOD	POOR	0.68	1.0
6. IRON-PEENING	.28	0.10	FAIR	GOOD	POOR	GOOD	POOR	0.68	1.0
7. ZINC	.26	0.20	GOOD	GOOD	GOOD	?	GOOD	0.63	1.0

very few even approach the over-all excellence of lead shot. A comparison of a few representative candidates is shown in Table 2:

From Table 2, it is obvious that no metal approaches lead in all-around suitable properties for shot. However, there is a leading candidate, if slightly reduced performance is acceptable, with several variations as shown in Table 3:

Because iron is the nearest practical substitute for lead in shot, representing a minimum number of compromises, Winchester-Western conducted extensive programs to develop practical processes for iron shot manufacture and to develop load modifications which would allow the use of iron shot in existing shotguns.

A major research and development program during the 1950's at

TABLE 3

POSSIBLE SUBSTITUTES - LEAD SHOT

1. IRON SHOT - WITH PROTECTIVE LINER
2. IRON SHOT - WITH PROTECTIVE COATING
3. IRON SHOT - ANNEALED PURE IRON

Olin resulted in the development of a proprietary process for the manufacture of pure iron shot which was culminated by patent coverage. This study showed that not only was pure iron shot essential to minimize barrel damage, but also that the shot had to be annealed to minimize scratching; and a protective liner was also required. However, while scratching was controlled by these means, there were four detractions:

1. Choke deformation still was encountered.
2. The shot was expensive—approximately 3 times the cost of lead shot.
3. A substantial capital investment was required for equipment for shot manufacture.
4. The shot tended to age harden on storage with progressively greater bore and choke damage.

In addition to disadvantages in the form of higher cost and barrel damage, iron shot has distinctly lower performance levels than lead shot due to its lower density. This factor has two effects:

1. Less shot weight can be loaded in a shell, and
2. Exterior ballistic performance is severely affected because of the lighter pellets.

To illustrate the first factor, a comparison of maximum practical shot weights in a standard 12 gauge shell is shown in Table 4:

In addition to the difference in performance due to the decreased weight of shot charge which can be loaded in a standard shotshell, there is a distinct performance decrease with iron shot due to the reduced weight per pellet. This lower pellet weight results in a much higher deceleration for iron shot than for lead when shot of equal diameter is used, and it cannot be overcome by raising the muzzle velocity with iron shot. The only partial compensation is to use a larger size of iron shot than lead to somewhat offset the lower density.

This effect is shown in the graph of shot velocity versus range shown in Figure 1.

For example, while the lead shot loses about 45 percent of its original velocity in traveling 60 yards, the iron shot loses 65 percent of

TABLE 4  
MAXIMUM LOADS - 12 GA. 2-3/4" SHELL

<u>SHOT TYPE</u>	<u>MAX. LOAD</u>	<u>MAX. VELOCITY</u>
LEAD	1-1/2 OZ.	1315 FT./SEC.
IRON	1 OZ.	1460 FT./SEC.

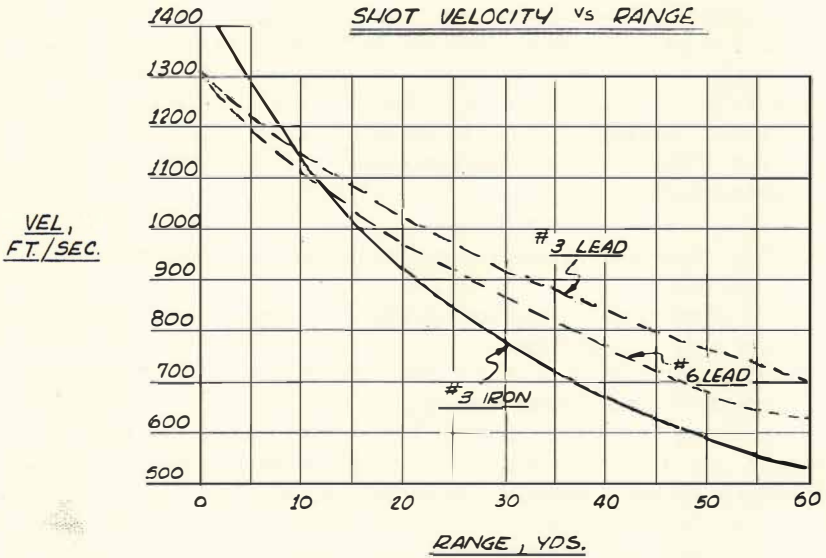


Figure 1.

its original velocity. This higher deceleration for iron shot is due to its lower density.

An even more significant factor is the loss in pellet energy for iron shot which is far greater than for lead shot. These characteristics are plotted in Figure 2:

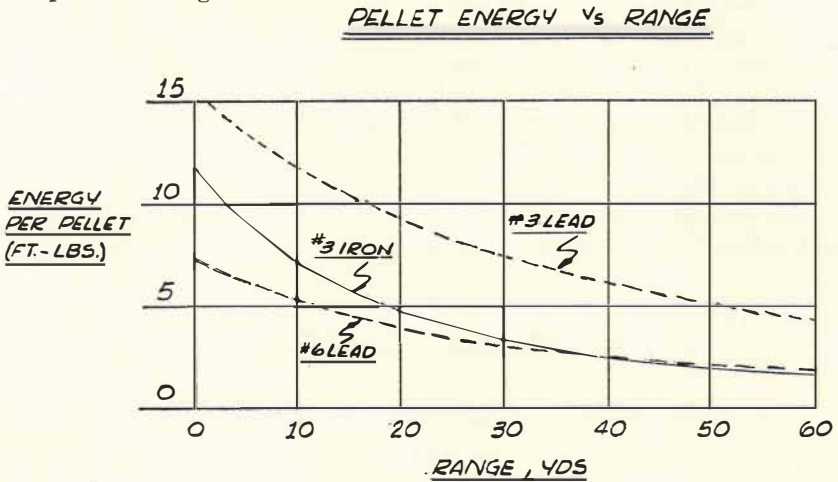


Figure 2

LOAD EFFECTIVENESS - LEAD & IRON SHOT

	<u>IRON</u>	<u>LEAD</u>	<u>LEAD</u>	<u>LEAD</u>
SIZE	(NO.4)	(NO.4)	(NO.4)	(NO.6)
SHOT WEIGHT	1 OZ.	1 OZ.	1-1/2 OZ.	1-1/2 OZ.
PELLETS IN LOAD	220	135	203	338
MUZZLE VEL. FT./SEC.	1460	1315	1315	1315
VEL. AT 40 YDS., FT./SEC.	695	810	810	760
ENERGY/PELLET - 40 YDS.	2.15	4.71	4.71	2.47
PELLETS - 70% PATTERN	154	94	142	236
TOTAL LOAD ENERGY FT./LBS.	330	445	670	580

TABLE 5

When total load effectiveness (the total load energy delivered at any range) is considered, the difference is even more striking. This, of course, is the combination of the total weight of the shot charge, the remaining pellet energy, and the pattern effectiveness.

For example, considering an effective range of 40 yards, and representative full choke patterns of 70 percent, the performance comparison for lead and iron shot is shown in Table 5:

Table 5 shows that when considering maximum hunting loads in a 12 Gauge 2 $\frac{3}{4}$ " shotshell:

1. For the same size pellet, there are about the same number of pellets in the pattern for lead and iron (203 versus 220).
2. The lead pellets have twice the energy at 40 yards.
3. Total load energy thus is about double for lead shot.
4. It is necessary to go one or two shot sizes larger in iron shot for equivalent killing power (energy per pellet and total energy in the pattern) compared to lead.

Since pure annealed iron shot has a substantial cost disadvantage compared to lead shot, Winchester-Western conducted an extensive search into other types of iron or steel suitable for shot which might offer a lower cost substitute, particularly for special types of shooting where long range effectiveness was not an important factor.

As a result, iron peening shot has been tested extensively; and this type of shot was used in the recent Nilo Farms evaluation. It has the desired lower cost (10¢ per pound versus 16¢ for lead, and 41¢ for pure iron shot), but has the same ballistic limitations as annealed iron shot and is far more damaging to gun barrels.

There is no practical barrel protecting material yet developed to our knowledge which works with peening shot. Choke life is very short, even with very thick liners (.040") as full chokes were opened to improved cylinder in firing a few hundred rounds. Typical

types of peening shot are shown in Figure 3, and illustrate the surface conditions which accelerate barrel damage.

In summary, as a result of several years experimentation with iron shot, Winchester-Western concludes:

1. A high-quality pure iron shot can be manufactured at a cost about 3 times that for lead shot (not including facility amortization).

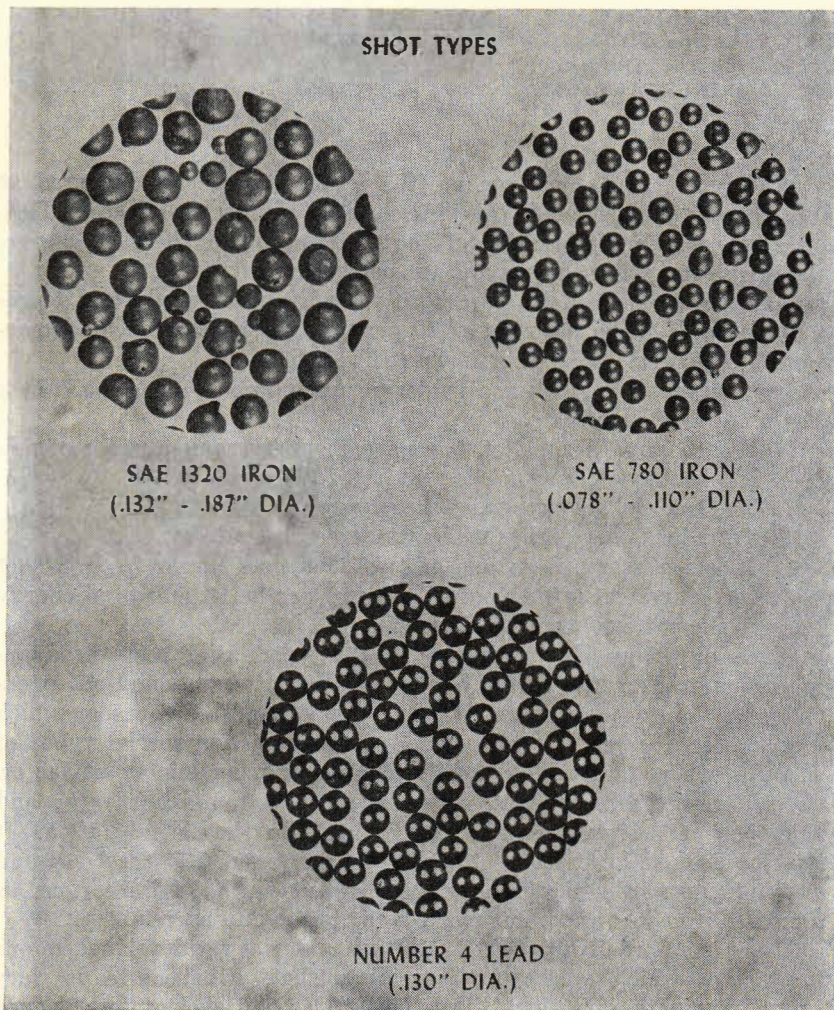


Figure 3

2. Barrel and shot protectors are required to reduce barrel and choke damage—but will not completely eliminate it.
3. Low cost peening shot is slightly more economical than lead, but has very poor barrel damage characteristics, even with very thick shot protectors.
4. Ballistic effectiveness of iron shot is inferior to lead due to less shot in the load and less energy at game ranges compared to lead shot.
5. No coating has been found for iron shot which will protect the barrel or choke. In addition, coatings evaluated to date are relatively expensive and affect the pattern adversely.

At the present time, there is no substitute for lead shot which can be considered practical. Even if we accept the reduced performance levels delivered by iron shot (reduced effective range), we have no answer to the problem of barrel damage.

As a major manufacturer of sporting firearms, Winchester-Western is fully aware of how particular customers are with their guns and the pride a gun owner has with his favorite arm. Even aside from the aesthetic aspects of this problem, repair and/or replacement of damaged barrels would be a most severe problem.

Although efforts to date to develop an acceptable substitute for lead shot have been unsuccessful, Winchester-Western is continuing its programs in this area to find a feasible substitute from the dual standpoints of reduced toxicity and more attractive economics.

## IMPLICATIONS OF THE REPORT BY THE ENVIRONMENTAL POLLUTION PANEL, PRESIDENT'S SCIENCE ADVISORY COMMITTEE

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*Restoring the Quality of Our Environment*, the report of the environmental pollution panel of the President's Science Advisory Committee, is the work of nearly 50 scientists and engineers drawn from federal and state governments, private industry, and universities. The membership of the principal panel and the 11 sub-panels strikes nice balances of representation among disciplines concerned directly with man and those concerned directly with organisms other than man; between physical and biological sciences; between pure and applied science; between economic and aesthetic values. The diversity of all the experiences and viewpoints thus brought together has tended to cancel out biases such as have often characterized reports on the pollution problems. This is clearly reflected in the Panel's definition, which is the preamble to the report:

"Environmental pollution is the unfavorable alteration of our surroundings, wholly or largely as a by-product of changes in energy patterns, radiation levels, chemical and physical constitution and abundances of organisms. These changes may affect man directly, or through his supplies of water and of agricultural and other biological products, his physical objects or possessions, or his opportunities for recreation and appreciation of nature."

With this broad definition, the scope of the report includes contaminants that are released into the air, soil, fresh waters and the sea. It includes municipal and industrial sewage, and the excreta of farm animals which overfertilize surface waters and cause objectionable growth of algae and larger water plants. It includes mining wastes, and all the refuse associated with our technological age, such as paper, metal, garbage, broken glass, bottles, cans, packaging materials, discarded automobile bodies, discarded machinery, all of which is spread over unused land and sterilizes it. Pollution includes noise. It includes the many gases produced by combustion of coal, oil, gas in our homes, vehicles and factories. Some of these gases become the noxious constituents of smog; others, like carbon dioxide, are accumulating in such large quantities that they may eventually cause significant climatic changes.

Among its many recommendations the Panel distinguished certain ones as principles. These should guide attitudes of the general pub-



lie as well as policies and actions by governments. To begin with "The public should come to recognize individual rights to quality of living, as expressed by the absence of pollution, as it has come to recognize rights to education, to economic advance, and to public recreation. Like education and other human rights, improved quality of life from reduced pollution will be costly to individuals and governments."

*The quality of life* is a theme threading all the way through the report and accepted without question by even the most hard-headed panel members. Thus the Panel declared: "All concerned should recognize the quality of human life and the presence and growth of other living things as the major values currently damaged by pollution . . ."

"Quality of life" as used here implies good quality. It means more than mere absence of pollution. It means more than an optimum subsistence with good housing and all the labor saving gadgets human ingenuity can contrive. In the context of this report it implies keeping unimpaired the physical and biological attributes of our environment for our physical and mental comfort and well-being as well as for our aesthetic enjoyment. It implies recognizing fully, respecting and protecting the mechanisms of the far-flung ecosystems on which man depends."

"Obviously," says the report, "man cannot live alone in a biological desert. He depends directly on many species of plants and animals, not only for subsistence but for embellishment of his life. Scientific agriculture and husbandry are based on a simple principle: If the environment is kept favorable, these living resources will renew themselves. Yet the conditions making environment favorable are often exceedingly critical, differing from one species to another.

"Man must reckon with the fact that just as he depends on an assortment of renewable resources which are directly useful to him, so also do all other species depend on their own assortments of renewable resources. Accordingly, the species of plants and animals which man depends upon indirectly are very many times more numerous than those which he uses directly. They include bacteria breaking down detritus into the inorganic nutrients that crop plants can utilize. They include invertebrates reducing dead animals and plants to detritus. They include invertebrate animals which are essential foods to birds, to insect-eating mammals, to fishes. They include insects that pollinate flowering fruit and other trees. Altogether they constitute *man's living environment*. No one is independent of this, not only if he lives on a farm in the country, but even if he spends

his entire life in a city of concrete and glass and buys all his food at the corner supermarket. Any one of us is likely to be more or less affected when pollution defiles a habitat, even one we have never seen. In short, the quality of man's living is highly correlated with that of an infinite number of other organisms."

While certain basic principles laid down in the recommendations state individual rights with respect to pollution, others emphasize responsibilities. Thus "The responsibility of each pollutor for all forms of damage caused by his pollution should be effectively recognized and generally accepted." There should be no right to pollute. Again, "As our pollution problems become steadily more serious, it should be generally recognized that we must consider our balances and choices within successively larger and more complex systems. Garbage disposal by burning, landfill, or household grinding, for example, sends the resulting pollution to our air, to our soil, or to our waters. In the last analysis, we cannot treat even these three broad classes of pollution separately."

One cannot read this report through without independently reaching the conclusion that although people tend to blame someone else for bringing the pollution problem upon us—industrialists, the community next door, the previous generation—no one can honestly claim innocence. All of us must share the responsibility of pollution, consequently must share directly or indirectly the cost of correcting it. For all of us contribute to pollution by our domestic sewage, the exhaust fumes of our cars, the chemical wastes of factories that serve our needs, the refuse of our communities. Since these wastes are produced in enormous quantities they must be removed. Since they are of almost infinite variety means of removing them are varied. Some are trucked beyond the edge of cities and spread over unused land; some are dumped into rivers to be carried down stream; some are barged out to sea; others are released into the atmosphere to be diffused by air currents. The intent is to get the unwanted material out of the way and out of sight, but the effect is to disseminate it and its influence far and wide. Thus pollutants become geographically wide-spread. Nor are their movements retarded by political boundaries. For pollutants become dispersed by air, water and migratory animals and affect environments far from their points of origin.

Hence, the responsibility of the individual in all matters concerning pollution is to his neighbor; that of the community to the adjacent communities; that of the state to neighboring states, of the nation to other nations, and of the present generation to the next. In other words, pollution control is basically a matter of ethics. The

Panel tacitly assumed that when people are confronted with alternate courses of action affecting the public good, the great majority will usually choose the more ethical one if they are fully and truthfully informed, or if they have set before them a good example. This assumption is implicit in several of the recommendations; for example, "All agencies and organizations concerned with pollution should strengthen programs that lead to better public understanding of pollution and its problems." Again, "Federal agencies should give special attention, in all operations they conduct, support or control, to avoiding and managing pollution, both to reduce it and as an example to others. State and local agencies should follow the federal example as rapidly as possible.

The Panel pointed out the responsibilities at the various government levels by this principle: "The roles of all governmental authorities, local, state, and Federal, in pollution problems should be complementary and mutually supporting. While enforcement of pollution control is primarily a regional, state or local responsibility, there is much that the Federal Government can and should do to support and supplement regional, state, and local action."

Recognizing the difficulty of legislating or enforcing ethics, the Panel recommended that careful study be given to tax-like systems in which all polluters would be assessed according to the amount which they add to the pollution load. Federal and local efforts to reduce pollution of air, soil and water have usually depended on a mixture of prohibitory regulation and persuasion. Sometimes these means have been appropriate and effective but unfortunately not always. Effluent charges would encourage those assessed to reduce the volume of their pollutants in order to save money.

From the viewpoint of those interested in fish and wildlife resources one of the most important implications of the report is that pollution is inseparable from the total complex of conservation problems. There is ample evidence that pollution dislocates ecological systems. For example, contaminants often seem to select against predators. "This can happen if predators are particularly sensitive to the poison; or if they feed on tolerant organisms containing higher concentrations of the poison; or if some essential food supply is eliminated by the poison. Organisms feeding upon other organisms take unto themselves the chemical constituents of their food. If these chemicals resist degradation and elimination they tend to accumulate at the far end of the chain of food and feeding. Thus storage levels of contaminants are lowest in plants, higher in herbivorous animals, higher still in carnivores. But of course pollution is only one of many influences affecting the composition of communities.

Others are competition within and between species; quality and quantity of food and nutrients; and physical factors such as temperature, rainfall and chemical composition of soil or water. All animal populations, including those free of man's interference, fluctuate continuously in response to these processes. Man's exploitation, as in timber harvesting, hunting and fishing, also influences both abundance and species composition. Rates of exploitation change continually with prosperity and growth of the human population."

Consequently, "To deal with the effects of pollution adequately means doing many things which we have left undone. To begin with, we must enlarge our concept of biological resources to recognize the integrity of our living environment and the importance of its diversity. Our habit has been to attack conservation problems piece-meal, as though the only species worthy of attention were those that are most valuable economically, or most interesting as curiosities, or most obviously in danger of extinction. We have tended to treat each species as an entity more or less independent of other species; each question as a subject for separate action; each geographical area as though it were an island. Pressures from groups of people with special interests, usually with biases about what should be done, where it should be done, who should do it, and what segments of the public should benefit, have helped to form this habit, to divide government agencies with "conservation" functions into more or less independent specialized compartments. Once thus fragmented, how can they deal effectively with complex problems involving large geographical areas, with the interactions of many diverse groups of organisms composing natural communities, and with the influence of physical factors of environment and of man's multifarious activities such as exploitation, land development and pollution? It is largely because of this fragmentation that the most elementary need of all who strive to effect scientific conservation remains unfulfilled. This need is for nationwide records, of statistically acceptable quality, of the numbers and distribution of animals and plants and of changes in the physical components of their environments. These records should represent the full scale of ecological situations, and within each situation all levels of community structure." In other words, the Panel would give conservation agencies the strongest possible encouragement to focus on ecosystems rather than species or types of organisms.

Certain of the Panel's recommendations are especially significant from our particular point of view. For example:

"Quantitative baseline population densities should be established by systematic sampling of certain natural populations in di-

verse relatively unpolluted habitats to establish a basis for comparison with populations under pollution stress."

"Immediate steps should be taken to plan and institute a National Environmental Quality Survey, which would provide benchmark data on the average condition of the environment of the people of the United States as a whole. An agency should be set up to carry out planning, including sample design and analysis of (this) survey. This agency should be isolated from all enforcement or action programs and should make the greatest possible use, through transfer of funds, of expertness in carrying out measurements of environmental quality already developed in Federal, state and local governments."

"The Federal government should expand substantially its inhouse and sponsored research in many broad areas, including:

- The effects of pollution on wildlife and fisheries, directly and through their habitats.
- The effects on beneficial insects, crops, forests, domestic animals, birds and agricultural lands.
- the effects on our coastal lowlands, estuaries, marshes, and lagoons."

Altogether the Panel made 104 recommendations, ending on the slightly apologetic observation that this was not an exhaustive list. It is indeed an extensive list, and reaches into all the ramifications of public affairs having anything to do with pollution, giving thoughtful advice, mostly, though not exclusively, directed to the Federal Government, as to what should be done or not done.

The recommendations are concerned with functions, policies organization and programs of government. They point out problems that require special attention. They propose means of coordinating the various activities of the federal agencies with regard to pollution, in order to eliminate duplication, fill gaps in knowledge, improve the quality and efficiency of their work, and to improve dissemination of information.

They propose that committees be established in the Federal Council of Science and Technology, National Research Council and National Academy of Engineering, to be variously concerned with identification of new pollution problems and new aspects of old ones, and for undertaking special studies to stimulate solid waste technology. A number of the recommendations were directed towards improving the numbers and quality of trained people engaged in key actions, from research to enforcement, chiefly by support of universities through grants, contracts, fellowships, traineeships and so forth.

The pollution Panel's report had almost immediate important effect. It was published in November, 1965. Three months later, President Johnson proposed the transfer of the Water Pollution Control Administration from the Department of Health, Education and Welfare to the Department of the Interior and establishment of the Clean Rivers Demonstration Program for which he asked a first year's appropriation of \$50,000,000. Further, the President recommended that federal support for state water pollution agencies should be doubled; that federal authority for enforcing abatement of water pollution should be clarified and strengthened; that federal research, financing and technical assistance should be improved and increased to help states and local governments take the measures needed to control air pollution. Time may well prove this report to be one of the most significant advances in the history of conservation in this country. I have tried to bring out some of the more significant features of this report and have quoted several passages that are likely to be of special interest to you. Although they provide a fairly representative sample; there can be no substitute for reading the report in its entirety. I recommend it to you.

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## MAINTAINING WATER QUALITY

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For some time conservationists have been aware of the value of our water resources and the necessity for water conservation. Many are also acquainted with the problems of water quality and quantity especially in urban areas and in the West. With the rapid growth of our population and the even more rapid expansion of our industry, we are burning the candle at both ends. We add an ever increasing waste load to our streams while at the same time we want more and more clean water for domestic and industrial uses. This is rapidly depleting or has depleted our water reserves. The question facing us today is: Can we maintain our water resources in sufficient quantity and quality to meet our needs now and in the future? This is not a rhetorical question. Our future well-being, in fact the very existence of our civilization, depends on how well we solve it.

As a people, we must come to recognize the vital importance of our water resources. Our water supplies must not be taken for granted. With our development of large cities and the increasing removal of our people from contact with nature, all too many feel that water comes from a tap. Like the little boy who believed that milk came from a bottle or carton, they give little thought to the source of their water supply, its quality, or the adequacy of the supply now and in the future. Public attitude regarding water supply and waste disposal must change.

Water is not a luxury but a necessity of life. All living things are largely composed of water and most need it every day. It is indispensable and, if we were thirsty enough, we would give all our worldly possessions for just one swallow of water.

Water supplies adequate in quality and quantity are essential for our economy. We need water for the growth and expansion of our industry; for irrigating crops and stock watering; for recreation; fish and game; aesthetic enjoyment; power and navigation; and above all for domestic use. Much of our recreation is water based. Most picnickers like to be near water. Millions swim, water ski or go boating; and more millions fish for relaxation and pleasure.

To insure our water supplies for the present and future, we must consider both quantity and quality. At the present time, sustained, usable stream flow is about one-third or less of total stream flow. The remainder runs off in floods so it cannot be used or is of undesirable quality. This is due in large part to deforestation, burning, overgrazing, unwise drainage, and agricultural practices, mining operations, road building, and other of man's activities. There has been a great deal of erosion and silting, vegetative cover and top soil have been removed from extensive areas, and as a result, surface runoff has increased and soil seepage has decreased with resulting reductions in spring flows. Thus the quantity of water which is available for sustained use is directly related to land management. At present, we are using only a part of our fresh water. In the not too distant future, we will need the total runoff and in some areas even this will not be enough. We must, somehow, increase the usage of our available supplies.

Water storage by means of reservoirs has been used in some areas to significantly increase the firm stream flow. This is especially useful when there is a well coordinated river basin development, as in the Tennessee Valley. Multiple purpose reservoirs such as those of the Tennessee Valley Authority can be of great value, albeit any reservoir represents but a moment in the geological time scale. The Federal Water Pollution Control Act recognizes the value of im-

pounding waters for streamflow regulations to control water quality—not, however, as a substitute for adequate treatment of wastes at their source. The Act requires that plans for every proposed federal reservoir include an evaluation of the need for, and the benefits of, storage for water quality control. This dilution principle, at best, is but a stopgap—a second line of defense, so to speak—against pollution. Even our best treatment, by today's techniques, leaves certain residuals in waste water discharges which increase in total quantity as populations increase. The best approach is to develop treatment methods for the various waste waters so they will not render the receiving stream unfit for any desired use. We have had these advanced waste treatment methods under study and development for the past five years and are now testing the most promising techniques in actual practice at certain locations. This advanced treatment approach will, when combined with a knowledge of water quality requirements, meet the pollution situation now and in the future; meantime, it's safe to assume that no water stored today for water quality control will go begging for other users, once it is no longer needed for dilution.

Desalinization of sea water offers another possibility, especially for the coastal areas. It may not be as practical for inland areas due to the cost of transporting large quantities of water. Our fresh water supplies depend upon rainfall and at present we have no economically feasible method of significantly increasing these supplies over wide areas. This means we must find ways to augment our present supplies. The most feasible method is water reuse. In most areas, we can no longer afford the luxury of using a water only once. We must use our water over and over. It won't wear out if we do not abuse it, and we can use it just as long as it is suitable for reuse.

This brings us to the other important consideration—water quality. Most water users desire a water of a certain quality. Therefore, for effective and efficient reuse of our fresh waters each user must return his used water to the source or stream in such condition that it does not render the stream water unfit for a desired use. This has not been done in the past, but such an approach is basic to the control of pollution and the reuse of water. This we must do if we are to preserve our aquatic resources and have water for our future needs.

The need to eliminate water pollution is becoming urgent. A host of materials are being added to our streams which render them unfit for one or several desired uses. Our rivers and lakes alike are being damaged. Detrimental effects on the small lakes have been noted, but damage is not limited to them. Not long ago, many felt that



our Great Lakes were immune; it was stated that there was no evidence that man's activities were having any effect on the open waters of the lakes. Subsequent developments have shown that this supposition was incorrect. The lake environment was being adversely affected but our analytical methods, until quite recently, were not sensitive enough to detect it. It is now widely recognized that the enrichment of Lake Erie has greatly accelerated eutrophication with a whole chain of undesirable effects. Certain areas of the other lakes, notably Green Bay, Saginaw Bay, and the southern end of Lake Michigan, are showing the effects of the addition of wastes. It is evident that pollution is a national problem. Many of our waters are being damaged or rendered unfit for desired uses due to the addition of wastes.

Because our waste inputs are rendering much of our fresh water resources unusable; because our water supplies are definitely limited by rainfall and our water needs are increasing rapidly; and since desalinization is costly for inland areas; it is evident that we must reuse over and over again the fresh waters we now have. It seems economically feasible and desirable to treat the water we now have at the point where we wish to use it. This does away with transportation costs; and further, even when polluted, our fresh waters contain but a fraction of the dissolved solids normally found in sea water. However, we face the problem of not knowing with certainty the kind and amount of treatment these waste waters should receive because we do not know the quality of water required for each of the common uses. If we are to effectively and efficiently renovate our fresh waters, we must know the quality of water required for each desired use. But how are we going to attain this knowledge? This is the first and most important question facing those engaged in water pollution abatement.

The approach to this problem has been somewhat confused. This is due in part to a lack of general agreement on the meaning of such terms as pollution, clean water, water quality criteria, water quality standards, effluent standards, and toxicity. This confusion and diversity of understanding have led some groups to fear water quality criteria and others to doubt the usefulness and adequacy of such criteria.

Before we can really understand each other, we must define our terms. I would like, therefore, to give my personal definition of these terms so that my approach to these subjects is clear. When defining water pollution, I refer to that which is due to man's activities. To me, water pollution is the addition of any material or any change in the quality or character of a water which interferes with, lessens or destroys a desired use.

There have been many attempts to define clean water in a meaningful way. Many definitions are long and involved; others try to cover all exceptions. A simple, direct approach is best. Clean water is water which is suitable for a desired use. By definition, if it is suitable it is not polluted. The same approach can be used in defining water quality criteria. Water quality criteria are simply the specifications required for a water for a particular use. It is apparent that these specifications, *i.e.*, criteria, will be different for different uses.

Stream standards include the specifications of quality applied to a stream or stream section.

Effluent standards include the specifications of quality applied to the waste waters discharged to a stream. Their purpose is to attain and maintain the quality of a stream water needed for a specific use or uses. In the past, there has been considerable argument concerning stream standards and effluent standards. Many seemed to feel that we should have one or the other and argued that point. In the writer's opinion we need both. The stream standards set forth the specifications for the stream water essential for a specific use or uses and this quality is secured and maintained through appropriate effluent standards.

Toxicity is another much misunderstood and misused term. Many pollution control laws state that no toxic materials shall be added to a stream. Experience has shown that this is not enforced, due in large part to its ambiguity. Waste dischargers point out that certain potential toxicants are already present at low concentrations in many receiving waters and they inquire as to why they must entirely remove these toxicants from their wastes before discharging them to a stream. Toxicity is a quantitative term. The mere presence of a potential toxicant does not necessarily create pollution. Materials become toxic only when their concentration, coupled with a time of exposure, exceeds a certain level. Most any material becomes toxic if it is present in excessive amounts. A good example of this which made headlines a few years back, was the mistaken addition of salt instead of sugar to the babies' formulas in a hospital. Salt, universally used as a food item, in this instance became toxic when too much was added. Further, many of the materials which are considered extremely toxic are needed in trace amounts for life. Selenium, for example, is essential in the human body but becomes harmful or toxic when its concentration exceeds a certain level.

The same is true of copper, zinc, manganese, boron, molybdenum, silicon, sodium, iodine, magnesium, iron, potassium, sulphur, and phosphorus. All these materials can be toxic when present above certain concentrations, but their presence in low concentrations is essential for life.

It should be clearly understood that water quality criteria for different water uses may differ widely. What may constitute pollution for one use may be beneficial for another use and have no effect on a third use. For example, the organic enrichment of a barren stream or lake could result in increased production of algae and other organisms in the food chain of fishes which would be desirable from the fisherman's standpoint. However, increased growth could be undesirable from the standpoint of bathers or boaters. Organic enrichment can very easily be carried too far because when too much of such materials are added, dissolved oxygen is lowered or depleted in some areas and pollution results. In the same way, if you add too much fertilizer to your lawn you kill rather than help the grass. Similarly, some trace elements are needed for growth but when present above certain levels they become toxic. Therefore, the approach to this problem would be not to exclude all organic enrichment or toxicants but to say that the concentration of these materials and potential toxicants shall not exceed the maximum level which is not harmful under conditions of continuous exposure. These levels are water quality criteria.

What is the need for and value of water quality criteria? As I have said, if we are to reuse our fresh waters effectively and efficiently, each user must return his used water to its source or to another waterway in such condition that the receiving water is not rendered unsatisfactory for a desired use or uses. To do this economically, he must know the water quality requirements for each of those desired uses, for how else can he meet the requirements or know if or how much he should treat his wastes? In rendering used water suitable and favorable for a desired reuse, the waste dischargers have no economic justification for doing more than necessary; but there is no justification for doing less because then they are wasting their time as they are not meeting the problem. It is apparent then that we must have definite knowledge of the water quality requirements for each water use (that is, water quality criteria) if we are to have a sensible, economic, and practical approach to the solution of our water resources problems.

You who have tried to abate pollution through court action know that, lacking definite knowledge of the water quality required for aquatic life, it is difficult or impossible to prove pollution.

When is a water polluted for a specific use? What constitutes pollution? What concentrations of potential toxicants make it polluted? At what concentration are the synthetic organic pesticides, the heavy metals, or the new petro chemical wastes not harmful to the aquatic biota under conditions of long-term exposure? We have very few of these answers. We must have them if we are to effec-

tively abate pollution and restore and maintain our water resources. However, we do know some of the answers and we should apply whatever knowledge and experience we now have to our existing problems. We cannot wait until we have all the answers. If we use the data we have now, we can make a very good beginning in the battle to restore and maintain our aquatic resources. We must not stand and wait while they are destroyed by what does down the drain. We can set criteria using the best available information, bearing in mind that they will be improved upon and added to as our knowledge increases. We must initiate effective and adequate research now to obtain those answers we must have to meet present and future water quality problems. We must have a basic, pertinent, efficient, large, and continuous research program to determine the quality of water required for each of our many uses of this great resource.

In this program we must put first things first. When a research project is proposed we must evaluate it by asking: Will it supply the data to abate water pollution? For too long we have had the cart before the horse. For too long we have been making surveys and re-surveys and collecting and recollecting data, simply because it was customary. For too long we have been putting the data we collected into pigeon holes because it was not pertinent, did not give us the needed answers, or we did not know how to use it. We must have a research program designed and conducted to determine the quality specifications for water for all of our various uses. Such a program is basic to efficient use of our water resources and essential if we are to have a sensible, economic, and practical approach to the treatment of wastes and the reuse of our fresh water supplies. Water quality criteria are, therefore, a key to the solution of our water resources problems.

Once determined, water quality criteria will be of value in a number of ways in meeting water resource problems. They will enable us to detect and evaluate the severity of pollution for various water uses. They will indicate our objectives in pollution abatement and waste treatment. They will supply the general public with essential basic information so they can more effectively support pollution abatement. Water quality criteria will serve to promote more uniform regulations throughout the country and especially in regions having similar conditions. Such objectively set requirements should reduce or eliminate the practice of industries threatening to move to other areas if antipollution laws are enforced and the playing of one area against another to gain concessions in waste treatment at the expense of our water resources.

Water quality criteria can be of great value to recreational, agri-

cultural, and industrial interests through the protection and maintenance of their water supplies. All these interests have need for a continuous supply of water of the desired quality and quantity. The time is past when an industry can move to a new area having clean water when the water supply in the old location becomes contaminated. From now on, all must use and reuse the water available with each accepting his responsibility for protecting the supply so it is suitable for reuse.

Water quality criteria can be of great use in the enforcement of antipollution laws. In the past, pollution control programs have been long drawn out, often due to requests for additional field or laboratory study, or because of delaying tactics and arguments over what concentrations of the wastes in question are significantly toxic or harmful, with the result that many times effective pollution control has not been realized. Delays and difficulties are understandable when the enforcement agency does not definitely know the quality of water required for the use or uses it is seeking to protect. An effective program requires better definition of water quality requirements. Cities and industries are reluctant to build waste treatment facilities when the objectives of waste treatment are poorly defined.

As a result, pollution control actions have mostly followed a familiar pattern, plowing over the same ground—arguing as to concentrations of wastes that were toxic or significantly harmful, and what concentrations of a waste should be allowed in the water. One can understand a reluctance to enforce a regulation which states that nothing toxic shall be added to a stream, when the waste discharger could ask: Why should we be required to remove all these materials from our waste when they are naturally present in small quantities in the receiving stream? Further, short-term bioassays with resistant species may be carried out in an attempt to show that fish can live in concentrations of the waste which were present in the receiving stream as a result of their discharge. Such tests have been used as evidence and, due to the absence of data on the requirements of more sensitive species and life stages of fishes or other organisms, the tests have been convincing. Lacking pertinent data to back it up, the pollution control authority is not likely to point out that the species tested were resistant to the wastes in question and that other species and life stages may be much more susceptible—as much as 1000 times or more—or that the tests (as sometimes happens) were concluded just before the test organisms die, though nothing was said to that effect. Without proper test procedures and data, who can state that levels of toxicants at which adult fishes can resist death for short periods or even for long periods, when they are

kept quiet, not fed, and not subjected to the normal environmental stresses, are no measure of conditions essential for survival of the species?

Concentrations of toxicants at which adult fishes can resist death for short periods are usually several times greater than those which, on longer exposure, would be lethal and are many times greater than levels which are safe for the biota. We must maintain the concentration levels which are *not* harmful to the biota under conditions of continuous exposure. A thorough knowledge of the water quality requirements is essential if we are to do this.

These are some of the objectives in the establishment of water quality criteria. When water quality criteria and standards are established, there will be a universal and clearer understanding of the problems and the basic water quality requirements for the various water uses. Then we can have a more effective program for the prevention, control, and abatement of water pollution. The existence of pollution will be readily detected and demonstrated, the need for waste treatment established, and pollution control facilitated. The question will be clear cut: Are the water quality requirements being met? If they are not, pollution exists.

In summary and conclusion, the restoration and maintenance of our water resources clearly pose one of the most important tasks facing the nation. Our aquatic resources have deteriorated; water pollution is the outstanding cause of this deterioration; our water needs have and will become greater; we must accelerate the national program to conserve our water resources if available supplies are to meet today's needs and those of the generations yet to come. Our people must realize that the program will be a costly and continuous one. We firmly believe that enhancement of our water supplies is worth our best efforts. Water is not a luxury but a necessity for life, and therefore worth whatever we must pay to get it. Nevertheless, we have no wish to pay needlessly or excessively as a result of mismanagement, ignorance, selfishness, or the making of a fast buck by the greedy at the expense of the water resources.

Most important in meeting the water resources problem is the attitude of the people. A strange attitude has grown up in regard to the use of our waters for the disposal of wastes. It has long been customary to throw things we don't want into streams. When we combine our wastes in a common sewer underground most of us cease to feel any further responsibility once they are out of sight and discharged to a stream some miles below town. This is the public attitude which must change. If it is socially unacceptable to dump your garbage on your neighbor's front lawn, the same social stigma must

attach to dumping your waste matter in his drinking water. In the past, we have to a large extent used our streams to purify our wastes, and we have used some streams as open sewers. As our population and industry have grown, so have the variety, complexity, and volume of our wastes; we have far exceeded nature's ability to carry out the purification task. We can no longer run our untreated or inadequately treated wastes into, and take our drinking water from, the same stream. We must now assume the cost of treating our wastes and the cost will not be small.

Our water problems involve both quantity and quality. Our firm water supply is but a fraction of the total run-off. Much of our water pours off in floods, unused. Good land management is the key to this situation. Reservoirs help to meet the problem but their life is limited, especially in unmanaged watersheds, and represent but a moment in geological time. Desalinization can meet the problem in coastal areas but transportation costs for the immense volumes needed may limit its use inland to areas having little fresh water. In only a few years, we will be using a volume of water equal to the total low flow of our streams. It is impractical to turn these streams around. Since our fresh water supplies depend on rainfall which we have not as yet increased significantly, our best solution is to use and reuse the fresh water supplies we now have where we have them. Reuse requires that each user return his used water to its origin or another water in such condition that it does not render the receiving water unfit for a further desired use. At this point, water quality and water quality criteria and standards come into the picture.

If a water user is to effectively and economically treat his used water so it does not render the receiving water unfit for a further desired use or uses, he must know the quality of water required for those uses. Since such information is largely lacking, water quality criteria based on a thorough knowledge of the water quality requirements for each use must be developed. This calls for an adequate basic and continuing research program to determine the quality of water essential and desirable for each use. Such a research program is essential if we are to establish adequate water quality criteria and standards. Water quality criteria are essential if we are to detect and evaluate pollution; determine our objectives in pollution abatement and waste treatment; provide a basis for uniform water pollution regulations for impartial treatment of water users; provide and maintain water supplies adequate and suitable for the various uses—domestic, industrial, agriculture, aquacultural, recreational, aesthetic, etc.; enforce pollution laws and regulations;

and, provide essential information so that the general public can become effective and efficient in meeting water pollution and water resources problems. Water quality criteria are the keystone for the abatement of pollution and the restoration of our water resources.

#### DISCUSSION

DISCUSSION LEADER GEORGE: Dr. Tarzwell is probably the number one water quality expert in the nation, probably in the world. You may recall that a year or two or three ago that the Wildlife Society gave him his Leopold medal for his work in this field, and we all value his counsel. Today he has not only given us a lot of technical information but has brought us up against the hard realization that these values have a lot of money involved. You saw one estimate for a million dollars to clean up Lake Erie alone. Therefore, if you have any questions on water quality, then here is your opportunity.

MR. EARL ROSE: I would like to ask Dr. Tarzwell if there has been any significant findings in the recent research concerning the more adequate treatment and more economical treatment of municipal and industrial waste?

You know, so many things have to be done to achieve these goals in so many areas that we can set standards all over but, on the other hand, it seems that the financial burdens of the cities are almost insurmountable now, requiring additional standards and policing. It seems to me this is a critical problem.

I might say that I attended the Midwest Governors Conference at Lexington, Kentucky, where it was revealed that many, many treatment plants are being built over the United States and that the state health department has not sufficient sanitary engineers to make even one visit a year to these facilities and, certainly, there is a lack of policing. It seems to me we have to have some real fine research to improve the systems we already have. I hope you can offer some answers to some of these things. I know they are working on them and have worked on them for many years, in increasing the efficiency of the plants, etc. However, this would also call for additional funds and perhaps something is being done that we do not at this time know about and which you might like to comment further about.

DR. TARZWELL: Of course, what you say is true. Further, we must face the fact that so-called complete treatment or secondary treatment takes out about 85 percent of the organic matter and there is 15 percent going down the drain. Now, 15 percent of a thousand is a great deal different than 15 percent of a million, and as our population increases, this 15 percent can overwhelm a stream.

In addition, the breakdown that we have in this method of treatment with the release of many nutrients is bringing additional problems. This is partly what I was getting at when I said that the public attitude has to change—that if the public is willing to pay as much for waste treatment as they are for perhaps cigarettes or liquor, I think they could meet any problem. However, it is true that we are going to have to pay more for waste treatment in the future.

These communities, if they do not care to have these waste treatment processes, are going to have to pay something in order to get drinking water.

Also, during the past five years, we have had various treatment groups working on this problem of pollution and treatment of waste. I was told by some of these people not so long ago that they know how to accomplish most of it. However, the costs are too great and, therefore, we need more studies in order to be able to do it more economically. Of course, we can take out organic materials through bacterial action, but little has been done directly for removal of toxicants. This is why I said we must have a change in attitude in relation to the people. They must face up to the problem and decide that they are going to do something.

Of course, on the matter of cleaning up bad streams, everybody is in favor of it, especially if the other person does it. However, we have to accept this responsibility ourselves, at least as I see it. There is no other way of doing it.



MR. GEORGE: You might be interested in an experiment being performed at Penn State. The University operates a disposal plant for state college and the effluent is put into a creek that flows into Spring Creek, one of the great trout streams of the country. It is on Spring Creek where they have Fishermen's Paradise. We found that the quality of Spring Creek went down considerably and, in an effort to improve it, we are now pumping 20 percent of effluent from the disposal plant over upland forest and farm area. We find this to be working out very well.

MR. JOHN GAVLON (Reporter, New York Times): I have just arrived here because I have been writing and filing a story in order to make a deadline. Therefore, maybe this question may have already come up.

However, we in New York City are very much concerned because the drought has now gone into its fifth year in relation to our using water out of the Hudson River. We have been assured that despite the fact this is a terribly polluted river that when the consumer gets the water it is palatable, pure and roughly the equivalent of fine water. However, I am rather curious about this and, therefore, would like to have the judgment of an expert on it.

DR. TARZWELL: Of course, in relation to water requirements, swimming requires a higher quality of water, bacteriologically speaking, than drinking water because we have efficient methods developed in our water treatment plants so that we can take water that is pretty much contaminated with high bacterial count and make it into a water which is palatable by removing the taste with activated carbon and by destroying the bacteria through chlorination so that it can be used for drinking water. Of course, I also know that in the West they have a little different idea—they do not allow swimming or boating or even camping around some of their waters while back into Ohio they do not allow swimming in the stream from which they take their drinking water. Therefore, there are different factors involved here. That is about all I can say in relation to your inquiry.

CHAIRMAN JOHNSON: Let me say that the questions asked by the last two speakers probably should be asked of sanitary engineers and I do not believe we have any such people in the group at the moment. They are quite professional people and they do have ways of working some of these things out. Therefore, please ask those questions of these individuals the next time you see them.

# TECHNICAL SESSION

Monday Afternoon—March 14

*Chairman:* JOSEPH J. HICKEY

Professor, Department of Wildlife Management, University of Wisconsin, Madison

EUGENE H. DUSTMAN

Director, Patuxent Wildlife Research Center, Bureau of Sport Fisheries and Wildlife, Laurel, Maryland

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## DISEASE, NUTRITION, AND CONTROL

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### METHODS FOR EVALUATING FORAGES FOR WILD RUMINANTS

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This paper considers feeding-performance experiments, digestion trials, and rumen assays as techniques for measuring forage quality and utilization for wild ruminants, especially deer.

#### FEEDING-PERFORMANCE EXPERIMENTS

Feeding-performance studies evaluate natural forages or artificial rations by the measured response of animals fed under controlled conditions. Groups of animals housed and fed in a common pen are inexpensive to maintain, but the quality of the data is frequently affected by between-animal behavior. Only broad characteristics of forages, such as relative palatability and usefulness, can be estimated. Feeding the animals individually minimizes between-animal behavioral problems and also measures the variation of response to the experimental conditions. Individual feeding is useful in deter-

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<sup>1</sup>The author is on the staff of the Wildlife Habitat and Silviculture Laboratory, which is maintained at Nacogdoches, Texas, by the Southern Forest Experiment Station in cooperation with Stephen F. Austin State College.

mining normal food consumption and condition change on a variety of experimental diets over a prescribed period. Neither group nor individual experiments are prohibitively expensive, but both must be according to some design, or else they allow only a very limited statistical analysis.

Very precisely controlled studies—e.g., equalized paired feeding—may be impractical, because of great between-animal variations in behavior.

On the whole, feeding-performance experiments are usually a first-generation research effort. Although cumbersome and limited in scope, they provide basic information on gross nutrient requirements and animal response to experimental and environmental conditions. Techniques and designs are discussed by Crampton (1963).

#### MEASUREMENT OF APPARENT DIGESTIBILITY

Feeding trials to measure the apparent digestibility of individual forage items have been accomplished many times. Deer have been confined in cages and pens of various sizes and designs, and fecal matter has been collected by harness devices, through mesh flooring, and even by vacuuming the pen floors.

Digestion trials should be arranged to minimize stress to the animals, and ideally to allow the quantitative collection of uncontaminated feces and urine, so that nitrogen balances can be calculated. It is difficult to satisfy both of these criteria in the same experiment. For deer a digestion trial normally requires a minimum of 2 weeks—7 days for conditioning the animal to test conditions, and 5 to 7 days for fecal collection. A one-day lag period usually suffices to equate food eaten and resulting fecal excretion. Forage and fecal analyses should at least include the apparent digestibility of protein and energy and probably also of cell and cell-wall components. Several general references, e.g., Maynard and Loosli (1956), describe digestion trials in detail.

Three types of rations have been fed during digestion trials. If portions of the growing or dormant plant are clipped and fed while fresh, the plant material sampled for chemical analysis must be similar to that eaten by the test animals. A second food source is plant material that has been clipped, dried, milled, and pelleted. This material is easy to sample for chemical composition, but there is little assurance that its digestibility resembles that of the original forage growing on range. A criticism of using digestibility studies to evaluate a single forage species is the unknown relationship between the determined digestibility of a forage fed as a sole food and its digestion when eaten with other species under range conditions.

Finally, artificial rations are useful because diets that vary in a single major component can be utilized to indicate the effects of this component on the digestibility of the ration. This may be more general and useful information than determining how a particular forage is digested under experimental conditions.

A second important use of artificial rations is the comparison of *in vivo* apparent digestibility with microdigestion values obtained from *in vitro* work. This *in vitro-in vivo* relationship makes it possible to predict the usefulness of forages by means of microdigestion studies.

#### RUMEN ASSAYS

Rumen assays have only recently been applied to the study of wild animals. They are valuable because rumen samples can be obtained from animals foraging on range, and the subsequent analyses are freed from many of the artificialities of feeding-performance and digestion-trial studies.

Both the solid and liquid rumen contents are used. In many studies the diet of wild animals has been determined from solid fragments. The liquid portion, which contains among other things the end products of microbial fermentations and the rumen microorganisms themselves, offers several possibilities for analyses.

Results reported by Short (1963) suggest that deer and bovine rumen liquors differ in ability to digest cellulose and plant fiber. Possibly rumen liquor from other domestic animals is more similar to that of deer. If so, such animals (provided they can be easily handled) could supply rumen liquor for microdigestion studies to estimate the value of forages for deer.

Rumen samples are frequently taken from living domestic animals through fistulas. The value of reusing an animal, either for economic reasons or to remove or minimize between-animal variation, makes the fistula technique attractive. Successful rumen fistulation of deer has been reported by Short (1962) and Dziuk *et al.* (1963).

Deer carry the fistula well but the repeated sampling of rumen contents is traumatic to both the deer and the researcher. Some of the difficulties would be removed by the development of tranquilizers capable of reducing the threshold of excitability without impairing digestive function. Esophageal fistulation has not been reported for deer; the trauma associated with collection of samples might be severe.

Possibly the killing of deer is the most feasible technique for obtaining rumen samples on range. The labor and expense of maintaining captive animals are avoided, and stomach samples are available for identification and chemical analyses. In addition, the car-

cass can be used for subsidiary studies on body condition and meat quality. The major disadvantage is that rumen materials can only be sampled on one occasion from a particular animal.

Variations in the rumen ingesta from killed deer are related to time since eating and drinking, to diet, and perhaps to the effects of social order and rut upon food intake. Probably several animals would have to be killed to obtain statistically reliable mean values of digestive power. The number required is largely speculative at this time. Van Dyne and Weir (1964) found that six cattle or four sheep provided inocula for estimating microdigestion within 10 percent of the mean with 95 percent confidence.

Rumen liquor samples from deer killed on range can be obtained either in the field or in the laboratory after the entire animal or its excised stomach has been transported from the field.

Fresh samples (Brüggemann *et al.*, 1965) and fixed samples (Pearson, 1965) of strained rumen liquor have been subjected to microorganism counts and morphological studies. These efforts have differentiated between the microorganisms of red and roe deer grazing on a common range during the same season and have indicated differences in the microorganism populations of white-tailed deer on a common range at different seasons. Counts of microorganisms and their differentiation, at least to type, are related to the quality of the ingested forage.

The pH of freshly strained rumen liquor is closely related to diet, rate of rumen fermentation, and total volatile fatty-acid concentration (VFA). The pH is interpretable to diet because cellulolytic activity is diminished at levels below 6.5, whereas food components characteristic of succulent forage, e.g., sugars and starches, are digested. The pH of rumen liquor from mule deer shot during the summer in Colorado was significantly lower than that measured during the winter—probably as a result of increased fermentation rates associated with the succulent vegetation eaten during the summer (Short *et al.*, 1966).

The freshly strained rumen liquor frequently is also sampled for VFA. The sample is fixed with acid, alcohol, or some other additive that will kill the contained microorganisms (to prevent further fermentation) and refrigerated or frozen until analysis can be completed. The VFA concentration and composition are determined with either a column chromatograph (Wiseman and Irvin, 1957) or a combined gas-liquid chromatographic-titrimetric procedure (Parks *et al.*, 1964). Both characteristics are modified by the quality and quantity of the consumed forage. A comparison of the VFA content in the rumen-reticulum of red and roe deer suggested major differ-

ences in food habits between the two species (Brüggemann *et al.*, 1965), and the variation in the molar percent composition of VFA in Colorado mule deer suggested an increased fermentation rate during the summer (Short *et al.*, 1966). VFA data are enhanced by measures of the rate of VFA production as determined by microdigestion studies.

Microdigestion analyses can estimate the rates at which forage is digested. They can profitably utilize semi-permeable and all-glass systems in studies with wild ruminants. All preparations are accomplished in the laboratory before the animal is killed—they are in essence “just add rumen liquor and ferment” techniques.

The substrate samples to be digested may be forages compounded to resemble a deer's diet, recently collected samples from individual forage plants, artificial rations, or certain purified substances such as cellulose. The same substrate samples, in different *in vitro* fermentations, allow a comparison of the digestive power of rumen liquors from different deer. Microdigestion values bear a relationship to coefficients of apparent digestibility. For example, in white-tailed deer, rumen fermentations were greater on a diet of northern white-cedar than on bigtooth aspen (Short, 1963). Digestion trials by Ullrey *et al.* (1964), indicated better consumption and better utilization of cedar than aspen—suggesting that controlled fermentations reflect *in vivo* digestibility. Application of the same commercial ration in controlled digestion trials and as feeds and substrates in microdigestion studies will establish the relationship between *in vitro* microdigestion and *in vivo* apparent digestibility. After this relationship has been established, forage digestibility can be estimated by *in vitro* systems.

Several replicates of each substrate are prepared for the *in vitro* system. Some are “stopped” immediately after the system has been completed (0 hour); in others the fermentation is allowed to proceed for prescribed periods (e.g., 24 and 48 hours). The differences in the concentration and composition of the VFA and in the substrate levels between the 0- and the 24- and 48-hour fermentations represent VFA production and microdigestion.

Controlled fermentations similar to those for determining microdigestion and rate of VFA formation can, by slight modification, measure gas production by the microorganisms from the rumen-reticulum. Incubation experiments with rumen liquor from white-tailed deer fed alfalfa pellets, bigtooth aspen, and northern white-cedar indicated that total gas production was positively correlated with rate of VFA production and tended to be increased at lower pH levels. The more specific qualitative and quantitative differentiation

of the gases of fermentation was less easily interpreted (Short, 1963).

Rumen liquor from white-tailed deer in Texas has been incubated against a series of substrates—sucrose, starch, a commercial feed ration, a mixed forage sample, and cellulose—and total gas production has been measured by displacement, with a simple manometric device. This type of controlled fermentation allows a quick and relative comparison of the microorganism activity from deer foraging on ranges differing in quality. It also compares the quality of wild forage samples (used as experimental substrates) to that of substrates of known composition.

Rumen assays are considerably more versatile in evaluating forages or even habitats than are feeding-performance experiments or digestion trials. A significant advantage of microdigestion systems is that they can be programmed to evaluate several forages with the rumen liquor from a single animal. Rumen assays further permit digestibility comparisons among forages from different ranges at a single season, from the same range at different seasons, or among different wild ruminants for a single range in a single season.

In addition, rumen assays would seem potentially useful in estimating quantity of forage eaten from the range—especially during the winter. The estimates would be based on the total amount of fecal matter deposited on a range during a specified time (determined from pellet group surveys), and on dry-matter digestibility of eaten forage items as determined by microdigestion techniques. These several data would be expanded, by use of relationships similar to those proposed by Van Dyne and Meyer (1964), to yield estimates of forage removed. This technique might provide quantitative range data not presently estimated with precision.

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## DISCUSSION

DISCUSSION LEADER EUGENE H. DUSTMAN: I want to thank Dr. Short for a most interesting paper.

We have approximately ten minutes for discussion. I know that there are many interested in deer nutrition and nutrition of ruminants in general. Several states are concentrating on this. Colorado and Missouri come to mind immediately, and there are others, I am sure. Does anyone wish to comment?

DR. DAVID KLEIN [Alaska]: The rumen analysis or assay mentioned is perhaps one of the most effective techniques, and we certainly use it in some of our work in Alaska, but there is one caution that I think should be observed. That is, that frequently if you are assaying to determine qualitative differences in forage consumed or in range types, or kinds related to the condition of the animals, you find that behavioral differences in the animal have to be considered at the same time you are doing the assay work.

For example, we found that deer in low-altitude areas in the coastal regions of Alaska during midsummer consume forage that may be of high quality but not very abundant in comparison to forage in alpine areas, which is of high quality and generally abundant. So one deer in a low-altitude area may be able to seek out high quality forage, and therefore, have a high-quality rumen assay in comparison to one in a high altitude, but this factor has to be taken into consideration in comparing quality of the two areas and the quality of the rumen contents from a larger series of samples.

DISCUSSION LEADER DUSTMAN: Thank you, Dr. Klein. Would you like to comment, Dr. Short?

DR. SHORT: I agree that animal behavior is a very important factor here.

We feel that any time we use rumen assays to evaluate a range condition, we will have to sample a number of animals at a particular range and a particular season to cover a great many aspects of animal behavior that will enter in as complicating factors.

In many ways, such research in wild animals is a study in variation, and this implies that there is a considerable number of animals involved in any particular sampling procedure.

Your comment was a very good one. Animal behavior is, indeed, a complication that we must live with.

The reason for focusing attention on rumen assays at this time is that this is one of the more valuable techniques that has been made available to us in the last decade or so. It is one that has a great deal of potential in helping us solve some major wild ruminant range problems. I feel strongly that we are going to have to focus a great deal of attention on it in the future as a good procedural technique. It has wide application, but it has very many pitfalls. Thank you.



## EFFECTS OF DIETARY PROTEIN ON DEER<sup>1</sup>

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The objective of this study was to measure the effects of three dietary levels of crude protein on productivity of female white-tailed deer (*Odocoileus virginianus*) and on growth and development of fawns produced by them.

Measurements of deer killed during hunting seasons have shown significant differences in physical development and productivity from several regions of Missouri (Dunkeson and Murphy, 1953; and Murphy, unpub.). There was a progressive decrease in development and ovulation rates from north to south through the state. These differences were not related to genetic differences as deer herds in northern Missouri originated from deer transplanted from southern Missouri. Deer population densities were not great enough to cause quantitative restrictions of food. Therefore, the differences in physical development appeared most probably related to the nutritive quality of the diet.

Examination of rumen contents indicated that deer in southern Missouri were more dependent on native vegetation than were deer in central or northern Missouri (Korschgen, 1962). Kjeldahl nitrogen analysis indicated that the crude protein content of the most frequently utilized woody browse species was relatively low, about seven percent (Kjeldahl N X 6.25).

From these observations it was felt that the regional differences in physical development might be related to dietary deficiencies. Protein is essential not only for body maintenance, growth, reproduction, and lactation, but for effective digestion and metabolism of carbohydrates and fats (Dietz-1965). Since the analyses of woody browse indicated a potential low level of protein in the diet of deer in southern Missouri, protein was selected as the dietary variant for this study.

The authors wish to acknowledge the assistance of Clifford Caldwell, Area Manager, Charles W. Green Area, and of Billy Martin and Turner Christian in feeding and handling the deer. Dr. H. L. Willeke, Keith Panzer, and the research staff of Ralston Purina Company assisted with planning of the project and preparation of rations. Statistical analyses of growth rates were done by Dr. Donald Hazelwood,

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<sup>1</sup>This study was supported by funds from Federal Aid to Wildlife Restoration Project, Surveys and Investigations Projects, Missouri 13R.

University of Missouri, Department of Zoology. Post-mortem examinations of deer which died were performed by Dr. Loren Kintner, Pathologist, University of Missouri School of Veterinary Medicine.

#### PROCEDURES

This study was begun in December, 1962. Twelve pregnant does were available from a herd of white-tailed deer at the Charles W. Green Wildlife Research Area near Columbia, Missouri.

These 12 females were divided by random selection into three groups of four deer each and were confined in individual 15-foot by 75-foot pens. Each group contained one yearling and three adults.

Records of fawn production and growth of fawns from these females were available for the year prior to beginning of this study. The does had been fed Purina D and F Chow and shelled whole kernel corn prior to this study.

Purina D and F Chow was used as the control ration (13 percent protein). The protein level of the other two diets was reduced by the addition of ground corn cobs to the control ration. The rations were formulated to contain 7, 10, and 13 percent protein. Samples of each batch of feed were analyzed. These analyses showed average protein values of the diets to be 7.43 percent, 11.42 percent, and 13.04 percent. All rations were designed to be isocaloric.

Feeds were manufactured at the experimental mill of Ralston Purina Company in St. Louis, Missouri. To insure a continuous supply of fresh food, no more than a 30 days supply was mixed at any one time.

The original form of the rations was a coarse meal, but the females on the lower protein rations sorted through the meal and rejected the corncobs. This difficulty was overcome by pelleting the feed.

Feed was supplied on an ad-libitum basis with the thought that deer on the low protein rations might consume extra amounts of feed and thus raise the total protein intake. Personnel and facilities were not available to keep records of daily feed consumption, but the deer were fed more than they consumed daily. In later studies the consumption of D and F Chow was three to four pounds per deer per day.

Physical development of fawns was recorded at birth and at ten-day intervals until mid-November. Measurements recorded were: body weight in pounds, hind foot length and chest girth in centimeters. Hind foot length was measured from tip of the hoof to proximal end of the calcaneus. Chest girth was measured immediately posterior to the scapula.

## WEIGHT LOSS BY FEMALES

The 12 does were weighed and penned on December 21, 1962. All of them were in good condition and pregnant at the start of the experiment.

Weights were recorded at monthly intervals from December, 1962 to April, 1963. Weighing was discontinued after April to prevent possible injury to unborn fawns.

Unfortunately, one animal on the control diet died in January of injuries incurred during the penning operations. A doe on the 11-percent protein ration suffered a broken phalanges on the hind foot during the January weighing. The hoof was amputated and she survived. Replacements for these animals were not available.

Does on lower protein diets lost weight continuously during the winter (Table 1). Average weight loss for those on the lowest protein ration was 12.7 percent. Average weight loss for those on the intermediate protein ration was 11.3 percent (omitting the injured female, who lost 28.9 percent of her original weight). Does on the control ration lost weight during the first three months but began to gain weight in April as pregnancies advanced.

## PRODUCTIVITY AND SURVIVAL

Our data indicated that the reduced levels of protein in the diet had more effect on survival of fawns and females than on production of fawns (Table 2).

TABLE 1. WEIGHTS OF FEMALES

Ration	December	January	February	March	April
	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>
7% Protein	137	127	123	119	114
	118	112	111	109	109
	138	138	132	129	120
	125	117	115	110	109
	Average	130	124	120	117
11% Protein	121	117 <sup>1</sup>	100 <sup>1</sup>	96 <sup>1</sup>	86 <sup>1</sup>
	131	123	123	118	117
	119	118	115	111	113
	121	111	107	105	99
	Average	124	117	115	111
13% Protein	129	125	117	116	120
	108	109	107	111	115
	107	104	100	105	111
	Average	115	113	108	111

<sup>1</sup> Foot broken.

TABLE 2. PRODUCTION AND SURVIVAL OF FAWNS.

	1962 <sup>1</sup> Protein Level			1963 Protein Level			1964 Protein Level			1965 Protein Level		
	7%	11%	13%	7%	11%	13%	7%	11%	13%	7%	11%	13%
Producing females	4	4	3	4	4	3	4	3	3	3	3	2
Fawns produced	7	7	4	7	6	5	6	5	6	6	4	4
Fawn mortality related to malnutrition	0	0	0	5	4	0	0	0	0	3	0	0
Female mortality related to malnutrition	0	0	0	0	0	0	1	0	0	1	0	0

<sup>1</sup> All females on 13% protein ration.

TABLE 3. PHYSICAL DEVELOPMENT OF FAWNS AT BIRTH.

Ration	1962 <sup>1</sup>			1963			1964			1965		
	Body Weight Lbs.	Hind Foot Cm.	Chest Girth Cm.	Body Weight Lbs.	Hind Foot Cm.	Chest Girth Cm.	Body Weight Lbs.	Hind Foot Cm.	Chest Girth Cm.	Body Weight Lbs.	Hind Foot Cm.	Chest Girth Cm.
7% Protein	8.2	25.7	31.7	4.3	21.7	26.0	7.5	24.7	31.8	6.2	23.9	28.1
11% Protein	7.9	24.9	32.0	4.8	22.8	27.8	8.5	24.3	30.4	8.7	25.3	30.4
13% Protein	6.5	25.0	30.8	6.2	24.2	28.5	7.4	23.3	29.0	7.3	25.0	29.7

<sup>1</sup> All females on 13% Protein ration.

All of the mature females had produced twin fawns in 1962. Two of the three yearlings had produced a single fawn. All of the fawns survived. These data reflected the adequate nutritive quality of the diet prior to beginning of the study.

Production of fawns per female was reduced by the lower levels of protein. Average production for the three years was: low protein level—1.72 fawns per female, intermediate protein level—1.50 fawns, and highest level—1.85 fawns.

One of the does on the intermediate level was gored by a buck during breeding season in 1963 and produced only a single fawn for the next two years. If she had not been injured and had produced twins, the production for the intermediate level would have been 1.70 fawns per female.

Fawn survival was directly affected by the reduced protein level in the rations (Table 2). Eight of 19 fawns produced by females on the lowest protein ration died of malnutrition. Four of 15 fawns produced by females on the intermediate protein level died of malnutrition. None of the fawns on the control ration died of malnutrition. All animals that died were examined by a pathologist.

Fawns which died of malnutrition were dead at birth or died within the first few days post-partum. Apparent cause of post-partum deaths was starvation caused by delayed milk production by the females as none of these fawns had milk in its stomach. Verme (1962) reported that fawn survival was dependent upon adequate milk supplies soon after birth and that undernourished does delayed milk production or failed to produce milk. Kitts *et al.* (1956) suggested that post-natal mortality in fawns may be traced to inadequate lactation.

It is significant that all of the females carried fawns to full term despite the weight losses recorded during pregnancy in 1963. Even the injured female, who lost nearly 30 percent of her original weight, carried twin fawns to full term, but they were dead at birth. These data illustrate the point that counts of corpora lutea give an indication of potential fawn production but not of actual recruitment to the herd. Of the 19 fawns produced on the low protein diet, only 11 would have been added to the herd.

Survival of the mature females was also influenced by the reduction in protein. Two females on the low protein diet died of malnutrition. None of the females on intermediate protein or control rations died of malnutrition.

Lactation apparently produces a greater stress on the female than does pregnancy, as survival of females on the 7 percent protein diet seemed related to the stress of lactation. One of the does that

died had nursed twin fawns in 1962 while on a diet of good quality. In 1963 she nursed a single fawn on restricted diet. In 1964 she produced a single fawn, but died shortly thereafter. The other female that died had nursed twins in 1962, no fawns in 1963, nursed twins in 1964, and produced twins in 1965 but died 27 days later. At death this female weighed only 92 pounds compared to an original weight of 137 pounds, and fat content of the bone marrow was only 0.5 percent.

One of the females that survived the entire experiment on the 7 percent protein diet nursed a single fawn all four years. She produced twins in alternate years, but in each case one of the fawns died. The other surviving female nursed twins in 1962, nursed no fawns in 1963, nursed a single fawn in 1964, and nursed twins in 1965.

#### GROWTH AND DEVELOPMENT OF FAWNS

The growth of fawns produced in 1962 represented growth rates under penned conditions with good quality rations. Regressions of growth rates were:

$$\begin{aligned} \text{Weight (lbs.)} &= 4.77 + 0.51 \text{ Age (days)} \\ \text{Hind Foot (cm.)} &= 27.71 + 0.10 \text{ Age (days)} \\ \text{Chest Girth (cm.)} &= 33.94 + 0.27 \text{ Age (days)} \end{aligned}$$

These fawns on good-quality rations gained 0.54 pounds per day for the first 150 days post-partum.

Bandy *et al.*, (1956) reported that for fawns of Columbian black-tailed deer (*Odocoileus hemionus columbianus*) on a high plane of nutrition the regression of weight on hind foot was,  $\text{Weight} = 0.000081 \text{ Hind Foot}^{4.14}$ . Our regression for fawns of white-tailed fawns on a high plane of nutrition showed a similar relationship,  $\text{Weight} = 0.000013 \text{ Hind Foot}^{4.82}$ . A change of one centimeter in hind foot length produced a change of 4.14 pounds in black-tailed deer and a change of 4.82 pounds in our white-tailed deer.

Physical development of fawns at birth was very much retarded on the 7-percent and 11-percent protein rations in 1963, the first year of the study, but improved the second and third years. These data suggest that the physical characteristics of the rations may have contributed to this situation as the rations were pelleted after the first four months on the experiment.

Growth as indicated by weight gain was directly affected by amount of protein in the diet (Table 4). Weight gain of fawns on the control ration was significantly higher than weight gain of fawns on the lowest protein diet for all three years. (Table 7) and was significantly greater than weight gain of fawns on the intermediate

TABLE 4. REGRESSIONS OF WEIGHT ON AGE.

Ration	Year	Regression Formula
7% Protein	1963	Weight = 5.56 + 0.29 Age
	1964	Weight = 10.40 + 0.30 Age
	1965	Weight = 6.68 + 0.22 Age
11% Protein	1963	Weight = 9.61 + 0.31 Age
	1964	Weight = 10.66 + 0.34 Age
	1965	Weight = 10.85 + 0.32 Age
13% Protein	1963	Weight = 4.28 + 0.39 Age
	1964	Weight = 6.31 + 0.38 Age
	1965	Weight = 6.48 + 0.29 Age

protein ration during the first and second years. Weight gain of fawns on the intermediate protein ration was significantly higher than weight gain of fawns on the lowest protein ration during the second and third years. French *et al.* (1955) found that optimum growth of male white-tailed deer occurred on diets containing 13 to 16 percent protein.

Growth rate of the hind foot (Table 5) was also influenced by the amount of protein in the diet but not as much as growth rate as measured by chest girth (Table 6) or body weight (Table 4). Bandy *et al.*

TABLE 5. REGRESSIONS OF HIND FOOT ON AGE.

Ration	Year	Regression Formula
7% Protein	1963	Hind Foot = 25.26 + 0.09 Age
	1964	Hind Foot = 28.45 + 0.06 Age
	1965	Hind Foot = 25.73 + 0.06 Age
11% Protein	1963	Hind Foot = 27.30 + 0.08 Age
	1964	Hind Foot = 28.17 + 0.09 Age
	1965	Hind Foot = 27.75 + 0.08 Age
13% Protein	1963	Hind Foot = 27.03 + 0.09 Age
	1964	Hind Foot = 26.83 + 0.09 Age
	1965	Hind Foot = 25.95 + 0.08 Age

TABLE 6. REGRESSIONS OF CHEST GIRTH OF AGE.

Ration	Year	Regression Formula
7% Protein	1963	Chest = 29.15 + 0.21 Age
	1964	Chest = 35.75 + 0.16 Age
	1965	Chest = 29.75 + 0.16 Age
11% Protein	1963	Chest = 33.64 + 0.18 Age
	1964	Chest = 34.54 + 0.19 Age
	1965	Chest = 33.73 + 0.19 Age
13% Protein	1963	Chest = 31.30 + 0.23 Age
	1964	Chest = 32.05 + 0.23 Age
	1965	Chest = 29.65 + 0.21 Age

(1957) suggested that plane of nutrition had little or no effect on rate of development of the hind foot and that plane of nutrition had a greater influence on increase in heart girth than on growth of hind foot.

There was no significant difference between rations in growth rate of the hind foot during the first year of our study (Table 7). There was no significant difference in development of hind foot between the high and intermediate rations during any of the years. Growth rate of the hind foot of fawns on the lowest protein diet was significantly less than growth on the other two rations during the second and third years.

Increase in chest girth of fawns on the control ration was significantly higher than that on the lowest protein ration during the second and third years and was significantly higher than that on the intermediate protein ration for the first two years. Increased chest girth on the intermediate protein ration was significantly higher than on the lower protein ration during the second and third years.

Growth rate of twins is probably slower than growth rate of single fawns. In each year, the control fawns were raised as twins and one or more fawns on the lower protein rations were raised as singles. This factor may have influenced the observed difference in growth rates between rations.

DEVELOPMENT OF MALE DEER

The two fawns reared on the 7-percent ration in 1963 were both males. They were continued on this ration for the next two years. In November, 1963 the fawns weighed 46 and 56 pounds respectively and had no visible antlers. As yearlings in November, 1964, they weighed 66 and 86 pounds. Antler development was limited to inch-long buttons similar to those produced by fawns on high protein rations.

TABLE 7. T TESTS OF REGRESSIONS OF GROWTH.

Regressions	Rations 13% vs 7%			Rations 13% vs 11%			Rations 11% vs 7%		
	1963	1964	1965	1963	1964	1965	1963	1964	1965
Weight/Age	P < .01	P < .01	P < .01	P < .01	P < .01	N. S.	N. S.	P < .05	P < .01
Hind Foot/Age	N. S.	P < .01	P < .05	N. S.	N. S.	N. S.	N. S.	P < .01	P < .01
Chest Girth/Age	N. S.	P < .01	P < .01	P < .01	P < .01	N. S.	N. S.	P < .01	P < .01



One of these males died of malnutrition in October, 1965. His weight was not taken but his antlers at that time were six-inch spikes still in velvet. The other male weighed 110 pounds as a 2½ year old in November, 1965 and had antlers only 10 inches long. One antler was a spike and the other had a small fork.

These data agree with those reported by French *et al.* (1955) who reported that male deer on a low protein diet (4.5-6.5 percent) gained 20 to 30 pounds between the fawn and yearling age and, when continued to 2½ years on the low-protein diet, produced unforked antlers about 13 inches long. Weights of the antlers produced by 2½-year-old males also were quite similar. Antlers from their deer weighed 162 grams; antlers from ours weighed 149 grams.

#### DISCUSSION

Range deterioration in much of the United States generally is caused by overpopulations of deer which eliminate the most preferred and most nutritious deer foods (Leopold *et al.*, 1947). However, on some ranges in the southern United States, quality of foods may be so low that deer die-offs occur before any plants are eliminated from the range (Lay, 1956). Critical qualitative deficiencies may occur on southern ranges in late summer as well as in winter (Goodman and Reid, 1962).

This study indicates that protein content of forage may be the critical nutrient on some ranges and may account for the low productivity and poor physical development which has been observed.

Productivity, survival, and condition of breeding does were adversely affected by reduction of protein in the diet to 7 and 11 percent.

Post-partum survival of fawns was reduced by low levels of protein in the diet of pregnant females. Fawn mortality apparently resulted from delayed or inadequate lactation by undernourished does.

The rate of development of body weight, hind foot length and chest girth was retarded by reduction of protein in the diet. Body weight and chest girth were affected more than was hind-foot length.

Body weights and antler development of yearling and adult males were drastically retarded by a diet of 7 percent protein.

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## DISCUSSION

DR. FRANK B. BARICK [North Carolina]: I would like to ask either one of the authors of these two papers, since they are quite related, whether either of them have made any studies of the comparative nutritive value of browse and fertilized pasture grasses, as it pertains to the protein content.

MR. MURPHY: We have done no work on this comparison.

DR. SHORT: I haven't done a whole lot of work on this, but generally the fall-off of quality in grasses is more severe than that of browsses, and the decrease in quality of deciduous browse is considerably greater, of course, than that of green browse, but pasture grasses after hardening off or after die-back offer mighty slim forage.

MR. MURPHY: I would like to comment that food studies in Missouri have shown the about the only time that deer make extensive use of grass is in the early spring when it is in rapid growth, and therefore, probably has the highest nutritive quality. Would you agree with that, Henry?

DR. SHORT: Yes.

DR. BARICK: The reason I asked this question is that on some of our management areas, we have a rather extensive program of pasture planting. We find that in those years, even the winter periods, when we have poor mast crops, that deer made extensive and intensive use of the pasture areas. So in response to this reaction on the part of the deer, we are manipulating our pasture program so that we fertilize primarily in years when we don't anticipate much mast, and therefore, supplement it or complete it. We are trying to produce better food for the deer during those periods when we don't have good mast production. That is why I ask about the comparative nutritive value because these grasses do stay green during the winter.

DISCUSSION LEADER DUSTMAN: These are all on state managed areas?

DR. BARICK: Yes, sir.

DR. SHORT: I am pleased to point out that those are green grasses rather than those that had die-back.

DISCUSSION LEADER DUSTMAN: Does anyone else care to comment?

DR. MAURICE BAKER [Alabama]: I would like to ask Dean Murphy if, in view of the survival of fawns on low ration, you kept track of the food ration.

MR. MURPHY: No, Maurice, we did not.

DR. JOSEPH LARSON [University of Maryland]: I wonder if it would be appropriate for either of the two authors or anyone from the audience to comment on the possible significance of genetic variation within a species concerning the results of the trial on relatively small numbers of animals.

DISCUSSION LEADER DUSTMAN: That could be a sticky one to handle. Do either one of you gentlemen wish to comment on genetic variation?

MR. MURPHY: I don't think that there is any doubt that genetic variation

will have an effect on the physical development of the white-tailed deer. This is one of the factors used in splitting the species into some 30 races, but within Missouri, a single state, when we moved deer from one part of the state and started herds from the same genetic stock, I don't see how genetics could play a very big role.

MR. BILL HOLSWORTH [University of Western Ontario]: I would like to ask if any consideration was given to the amount of water that is given to the deer on different protein levels.

Some studies that have been done in Africa indicate that the amount of water controls the ability to handle low-protein diets.

Similar studies were done in western Australia, and they found that this also occurred in kangaroos, and I believe they have shown it to occur in sheep there. With regard to the previous question, there has been a paper by Eley in Western Australia indicating that there is probably a dimorphic population. Some animals are able to handle low nitrogen much better than others in the same population. Some handle it well. Some handle it poorly, and this is possibly related to whether or not they drink.

DISCUSSION LEADER DUSTMAN: Thank you, sir. That was very interesting. Would you, Mr. Murphy, care to comment on this water-protein relationship?

MR. MURPHY: I am going to hand that ball to Jack Coates.

MR. JACK COATES: Concerning the water intake of these deer in our protein studies, all had water available to them at all times, but we did not try to measure variation of water intake. If there was a difference, we didn't see it in the water measurement.

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## TYPE E BOTULISM IN GREAT LAKES WATER BIRDS

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The association of Type E botulinal toxin with an extensive die-off of loons and gulls on Lake Michigan was first reported by Herman (1964), who cited studies by Kaufmann and Fay (1964), and subsequent studies by Patuxent Wildlife Research Center of the U.S. Fish and Wildlife Service. The purpose of this paper is to review the subject of Type E botulism in water birds of the Great Lakes in light of more recent work.

### BOTULISM

Botulism is a food poisoning rather than an infectious disease. It is contracted through eating foods in which the organism *Clostridium botulinum* has grown and produced a very potent toxin. It may cause acute illness and death in many animals, including man.

*C. botulinum* is classified alphabetically into a number of types according to the specific characteristics of the toxin produced. In wildlife investigations we are chiefly concerned with two Types, C and E. Type C botulinum has been recognized as a major cause of mortality among waterfowl in North America for many years. Type

E botulism was not known to exist in wild birds until it was suspected during investigations of water-bird mortalities in Lake Michigan in 1963. It will be the main subject of this paper.

#### HISTORY IN MICHIGAN

Outbreaks of Type C botulism in Michigan date back to 1941 when it was found to be the cause of a die-off among wild ducks in Lake Erie marshes near Monroe. No more outbreaks were detected until 1961, when several hundred ducks and some shorebirds died in Saginaw Bay in Lake Huron. We identified Type C botulism in ducks and other birds in Saginaw Bay again in 1962, 1963, and 1964, and in Lake Erie near the mouth of the Lower Detroit River in 1964 and 1965. No accurate estimates of losses were obtained, but the total over the years must have been several thousand ducks and shorebirds.

The recent unprecedented losses of gulls, loons, grebes, and other birds on Lake Michigan in 1963 and 1964 have been documented by Herman (1964), Kaufmann and Fay (1964), and Fay, Kaufmann, and Ryel (1965). A brief account of the mortalities follows.

Michigan Conservation Department estimates, based on counts of dead birds on sample areas of beach in December, 1963, indicated that some 3,300 loons, 4,290 gulls and 130 birds of other species, mainly ducks and grebes, lay dead along the shore of the Lower Peninsula of Michigan.

Mortalities of similar scope occurred again in 1964, but along the north end of Lake Michigan. Conservation Department estimates based on sample counts of dead birds from St. Ignace to Wisconsin placed the loss at 3,570 loons, 820 gulls, 260 grebes, 240 ducks, and 30 miscellaneous birds. Losses occurred earlier in 1964 than in 1963, and the sample survey was made in late October.

Again, in 1965, significant losses occurred among loons, gulls, and grebes on Lake Michigan. Dead loons and grebes were confined largely to the north end of the lake; gulls were more widely distributed. Heavy losses also occurred among gulls on Saginaw Bay in Lake Huron. No sample surveys were made to estimate losses in 1965. Random observations indicated, however, that the mortality of loons was less than in either of the previous two years.

I should mention that the total of 12,640 dead birds estimated by the surveys in 1963 and 1964 is probably low. The surveys did not cover all areas of known losses. Furthermore, they included only birds dead on the beach at the time. There was evidence that some of the carcasses were buried by sand or destroyed by scavengers.

*Symptoms.* Sick gulls were observed on many occasions and showed symptoms in varying degrees. Birds most acutely affected

were completely prostrate with their wings limp alongside the body, or outspread, and the head lying on the ground. The picture was that of complete helplessness.

Gulls less affected were able to hold up their heads and move them about, but were unable to move their wings and legs. Many appeared fully conscious and by movements of their heads showed apprehension at the approach of a person. It was apparent that they made great effort to get away, but their legs and wings were functionless. They behaved as if "anchored" to the spot. Others could move their wings with effort. Some of these gulls flew quite successfully if they managed to get airborne. Other gulls were able to walk and fly, but their wings drooped noticeably when the birds were still for a moment. It was characteristic of these gulls to lift and adjust their wings repeatedly only to have them droop again. The symptoms in gulls characteristically appeared to be a muscular paralysis affecting the wings, legs, and neck in sequence as symptoms became more pronounced. Tremoring definitely was not a part of the picture.

Only a few persons had the opportunity to observe sick loons. The symptoms described are strikingly similar to those in gulls—paralysis of legs and wings, and in extreme cases, the neck.

I observed one sick red-necked grebe. It was at the edge of the water, unable to move its legs and wings, but with head erect in a defensive attitude. This bird improved enough in two days to swim away when I returned it to the lake.

*Diagnostic Studies.* We examined a large number of birds at the Conservation Department Wildlife Pathology Laboratory at Rose Lake Wildlife Research Center during the past three years. These included loons, gulls, grebes, mergansers, and a few miscellaneous birds associated with the die-offs. I found no evidence that starvation, injury, or parasitism was responsible for the mass mortalities. No pathogenic bacteria were found in samples of internal organs submitted for culture to the Department of Microbiology and Public Health at Michigan State University. The Fish and Wildlife Service's Patuxent Wildlife Research Center, in analyzing tissues from dead loons for pesticides, found very low amounts of DDT residues (Locke and Bagley, 1965), less than in other species of birds known to have died from DDT poisoning. This implies that the persistent chlorinated hydrocarbons were not important factors in the death of the loons.

What appears to be a significant finding was the occurrence of toxin of *C. botulinum* Type E in the tissues of a majority of the birds studied. Kaufmann and Fay (1964) found Type E toxin in a

high percentage of gulls and loons tested from 1963 die-off, and Fay *et al.* (1965) from gulls, loons, grebes, and mergansers from the 1964 die-off. I also found this toxin regularly in these species in the 1965 die-off.

#### RECENT STUDIES

The presence of toxin in sick and dead birds indicated that Type E botulism was involved in the mortalities. Since botulism is contracted through consumption of toxic food, it became important for us to learn what the birds eat.

*Gizzard Contents of Dead Birds.* The literature is generally lacking in information on the specific items in the diet of water birds of the Great Lakes. Food items from the gizzards of 149 loons, 28 gulls, 16 grebes, and 2 mergansers from the 1963 and the 1964 Lake Michigan bird die-offs were identified by personnel of our Institute for Fisheries Research at Ann Arbor. Alewives and yellow perch constituted the main food in a preliminary series of 15 loon gizzards examined (Fay *et al.* 1965). Peterson (1965) identified the food in 134 additional loon gizzards: alewives in 72 percent, smelt in 13 percent, sea lampreys in 7 percent, coregonids in 5 percent, mottled sculpins in 3 percent, yellow perch in 2 percent, unidentified fish in 23 percent, crayfish in 13 percent, and insect remains in 11 percent. Insect remains made up only a small fraction of the bulk of the contents, however. Small feathers and pieces of plant material were found occasionally. Pebbles as large as one-half inch in diameter were present in most gizzards.

Food items were identified in the gizzards of 28 gulls: 15 herring gulls, 9 ring-billed gulls, 2 Bonaparte's gulls, and 2 unidentified gulls. Alewives were found in 64 percent, yellow perch in 18 percent, smelt, coregonids and crayfish each in 3 percent, unidentified fish in 36 percent, and insects in 25 percent. Feathers were present in 32 percent, plant material in 32 percent, and pebbles in 14 percent.

Gizzards from 12 horned and 4 red-necked grebes were examined. Sculpins were found in 56 percent, alewives in 12 percent, crayfish in 19 percent, unidentified fish in 25 percent, insects in 75 percent, plant materials in 69 percent, feathers in 94 percent, and pebbles in 37 percent. Smelt and lampreys occurred in one bird each.

Gizzards of two red-breasted mergansers were examined in a similar manner. One contained smelt, the other unidentified fish and plant material.

Fish flesh or bones, were found in 95 percent of the loons, in all of the gulls, in 81 percent of the grebes, and in both mergansers. The apparent absence of the fungus *Saprolegnia* indicated that the

fish remains in the gizzards of the birds was not carrion (Peterson, 1965).

*Experimental Feedings.* Limited feeding experiments to test the toxicity of fish to captive ring-billed and herring gulls were carried out in the summer of 1965 at the Rose Lake Wildlife Research Center. Young flightless gulls were taken in July, 1965, from a nesting colony on Black River Island in Lake Huron and raised to adult size in pens at the Center. They were maintained on chopped Atlantic Ocean whiting and venison salvaged from deer killed by cars. The fish tested for toxicity were of three species obtained in 1965 from three sources in Michigan: (1) dead alewives collected in June from the beach of Lake Michigan in Muskegon County; (2) dead yellow perch and suckers collected in July along Saginaw Bay in Lake Huron; (3) fresh alewives, yellow perch and suckers, netted in October in Little Bay de Noc at the north end of Lake Michigan. All fish were frozen within a few hours after collection and kept frozen until fed to gulls.

The gulls ate better if kept with others in groups of four and five, rather than singly; so they were fed in groups. We generally offered the fish in the morning and again in late afternoon, and refrigerated the uneaten portions through the day to reduce further spoilage. Records were kept of daily consumption by each group of gulls. The total amount of fish consumed by ring-billed gulls in the experiments was: 3 pounds of dead alewives from the Muskegon County shore of Lake Michigan; 2 pounds of dead suckers and 6 pounds of dead yellow perch from Saginaw Bay; and 30 pounds of fresh alewives, 12 pounds of fresh suckers, and 17 pounds of fresh yellow perch from Little Bay de Noc. The total amount consumed by herring gulls was 2 pounds of fresh alewives, 27 pounds of fresh suckers, and 22 pounds of fresh yellow perch, all from Little Bay de Noc. The gulls showed a definite preference for fresh fish over that partly decomposed. There usually were, however, aggressive individuals within a group who would eat almost any kind of fish offered to them.

The most revealing outcome of the feeding experiments was the toxicity of dead alewives to gulls (Fig. 1). Two gulls died—No. 3 following the initial feeding, and No. 8 after the third feeding and after recovering from symptoms which followed the first feeding. Three gulls (No. 5, 10, and 13) became sick twice within a period of about 2 weeks. Not all gulls became sick with each feeding of alewives. Possible explanation for this may be the variability in (1) susceptibility of gulls to the toxin, (2) toxicity of the dead alewives or (3) amount of fish eaten. Some gulls showing no symptoms fol-

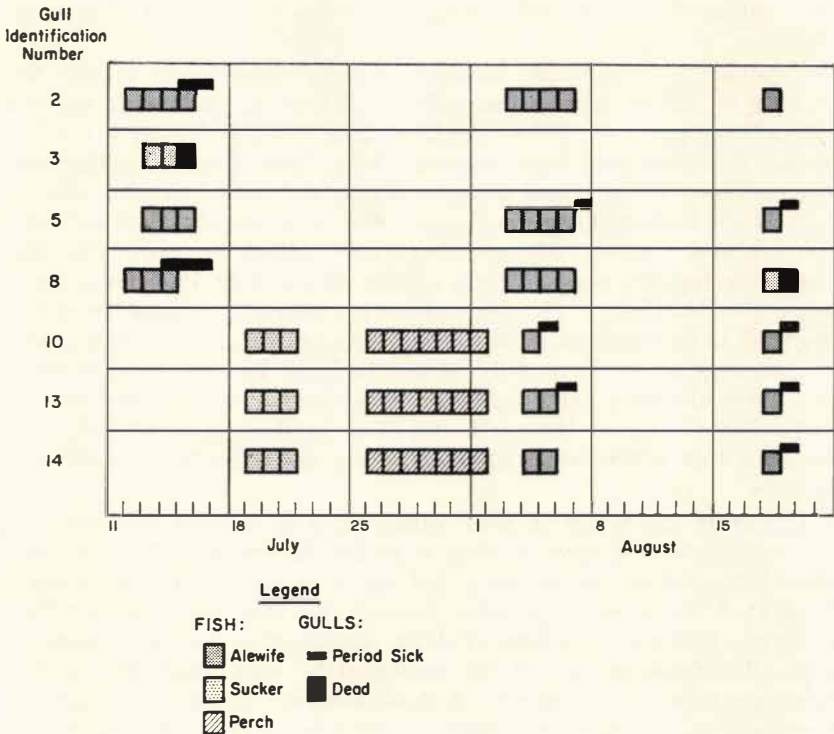


Figure 1. Results of feeding dead fish to captive ring-billed gulls. Fish found dead on lakeshore, June and July, 1965.

lowing a feeding became sick from a subsequent feeding, indicating they were not immune. The very small amounts of fish eaten in some instances may account for the apparent lack of toxicity in several cases. Unfortunately, Figure 1 shows when fish was offered but does not indicate the amount consumed by each bird. It is likely, too, that alewives varied in toxicity. I particularly noted an absence of symptoms in gulls fed a small collection of alewives caught alive but dying.

Gulls fed the dead alewives showed symptoms varying from a slight droop of the wings to prostration, and in two instances, death. Characteristically, the moderately affected birds were almost constantly shuffling and readjusting their wings, only to have them drop again. Wing tips of more severely affected gulls touched the ground. Even these birds were relatively alert and could fly if ex-



cited. Gulls affected even more had weak legs and necks. Their characteristic pose was to squat in hovering position with wings lying loosely at the sides and the head drooping. Frequently, the head was raised when the gull was alarmed, only to sink down slowly again. Prostrate gulls were completely limp, and the only sign of life was faint respiratory movement.

Symptoms usually developed overnight and were evident when we returned to work in the morning, approximately 14 hours after a meal of fish was put before the gulls. Symptoms seemed to reach maximum intensity about 20 hours after gulls were given a meal. One gull was dead, presumably from toxin, about 14 hours after feeding. Blood samples taken from the gulls (1) before a specific feeding experiment, (2) during the symptomatic period, and (3) after recovery from symptoms, were tested for toxin. A toxin identified as Type E botulinal toxin by the mouse test, using specific antitoxin, was present in the blood serum of gulls only during the period of symptoms.

Dead yellow perch and suckers from Saginaw Bay did not appear toxic to the gulls. These results are not conclusive, however, because only small amounts were tested. All groups of ring-billed and herring gulls given fresh fish remained healthy, indicating that presumably normal fish were not toxic.

#### DISCUSSION

The pattern of mortalities, the symptoms observed in sick birds, and the results of our laboratory studies, indicate that the mortalities of water birds occurring on Lake Michigan in 1963, 1964, and 1965, and on Lake Huron in 1965, were from the same cause. While numerous thoughts have been expressed in regard to the losses, I believe we can relegate some of the earlier considerations to the background, although we may not dismiss them entirely. Among these are infectious diseases, parasitism, starvation, and industrial and municipal pollution.

The role of DDT and other pesticides is not entirely clear at this time. Analyses by the U.S. Fish and Wildlife Service for DDT residues indicate DDT was not the cause of the loons dying. Also, the wide distribution of sick and dead gulls would seem to minimize the importance of DDT and other chlorinated hydrocarbons (prevalent in some Great Lakes waters adjacent to orchard areas) as the primary cause. Furthermore, the symptoms in sick gulls do not fit the classic description (tremoring) of birds poisoned by DDT and related pesticides. On the other hand, the distribution of pesticides

in the environment and food chains is a complex problem about which too little is known, and consequently, cannot be dismissed from further consideration.

While I have discussed the negative aspects, there is positive evidence to support a hypothesis that Type E botulism is the cause of mortalities. The symptoms shown by sick gulls—relaxation of wings and legs, general limpness in severely affected gulls, and retention of consciousness—are typical of botulism. These conditions may be explained by the action of botulinal toxin in exerting its main effects on the peripheral nerves and very little on the central nervous system (Brooks, 1964). This may result in paralysis of the skeletal muscles without the mental depression common to severe infectious diseases. The behavior of a sick red-necked grebe was very similar to that of the sick gulls, and symptoms described in loons by other observers seem to fall into a similar pattern. We may conclude that symptoms in these birds fit those of botulism.

The presence of Type E toxin in a high percentage of birds examined leaves no doubt that the birds acquired toxin in some manner. Some investigators have questioned the significance of the toxin in bird carcasses, as it was yet to be proven that the toxin was pathologic to the birds. Locke and Bagley (1964) reported that attempts at experimental verification of Type E botulism in gulls have been largely unsuccessful. More recent data, however, add support to a diagnosis of Type E botulism.

Kaufmann, Monheimer, and Solomon (pers. comm., 1966), in studies at Michigan State University, made ring-billed gulls sick by feeding them toxic laboratory cultures of *C. botulinum* Type E. Symptoms described by these authors could be interpreted as muscular paralysis.

The results of our feeding experiments at Rose Lake Wildlife Research Center showed that alewives under certain conditions are toxic to gulls. The presence of Type E toxin in the blood of the birds only during the symptomatic period indicated that it was the toxin that made them sick. Sick birds exhibit symptoms identical to those in wild sick gulls and closely resembled the symptoms Kaufmann *et al.* (above) described for their experimental birds.

Another consideration in the search for the cause of the water bird mortalities is the diet of the birds. Fish was by far the predominant food of all of the major species of birds involved. It would seem to be more than chance that the mortalities are more closely related to the diets than to the taxonomic relationship of the birds. The birds span four orders ranging from the lowest to mid-range in

developmental advancement according to the zoological classification of the American Ornithologists' Union (1957).

While I believe that most evidence points to Type E botulism as the cause of the mortalities, there is yet an unanswered question concerning the source of toxin to the birds. Part of the answer may be derived from the studies of Foster *et al.* (1965). They found the bacterium *C. botulinum* Type E common in fish in Lake Michigan, and occurring in fish of the other Great Lakes. It is conceivable that dead fish are made toxic by growth of the bacterium and subsequent production of the toxin in the carcasses. It might be expected that gulls, as scavengers, frequently feed on toxic dead fish. We have already shown that some dead alewives are toxic. However, this explanation does not appear to hold for loons, grebes, and mergansers, which, as far as we know, eat only live fish. Results of our limited feeding experiments indicate that live-caught (and presumably normal) fish are not toxic. Certainly, the matter of Type E toxin in birds, fish and other aquatic food-chain organisms warrants much more study.

Many questions arise concerning both Type E toxin and water bird mortalities in the Great Lakes. We ask if Type E botulism is new to the Great Lakes. If not new, why has it only recently caused heavy losses among fish-eating birds? We have records of localized and small losses of gulls over the past decade, but not on the scale of the past three years. We believe that the recent loon mortalities are unprecedented in Michigan waters. We could easily have failed to diagnose Type E botulism in the past, but it does not seem likely that such bird losses would have been overlooked.

We do know that the past decade has seen a most unusual change in the species composition of fish in the Great Lakes. Sturgeon, lake trout, suckers, whitefish and lake herring have declined seriously, and the tiny alewife, an invader from the Atlantic Ocean, is now the predominant fish in Lake Michigan (Smith, 1965). A thought for speculation is that, in addition to the phenomenal increase, the alewives have a characteristic that is new to the Great Lakes, in that nearly each year they die en masse. This is particularly true of Lake Michigan. Possibly, there is some connection between the accumulations of dead alewives and the bird mortalities.

Strangely, as far as I can ascertain from wildlife personnel of other Great Lakes states and provinces, the mass mortalities of loons are peculiar only to Lake Michigan. Perhaps the reason lies in the migratory pattern, but the meager information available on loons indicate they frequent most of the Great Lakes.

## SUMMARY

Botulism, caused by the toxin of the bacterium *Clostridium botulinum* and essentially a food poison to which many animals and man are susceptible, is classified into a number of types according to the character of the toxin. In wildlife investigations we are chiefly concerned with two types, Type C, and more recently, Type E. Type C botulism has been recognized for many years as a major cause of mortality among waterfowl. Type E botulism was first suspected in wild birds during investigations of water-bird mortalities in Lake Michigan in 1963.

Additional evidence has been gained to support an earlier tentative diagnosis of Type E botulism as the cause of mass mortalities of gulls, loons, grebes, and mergansers in Lake Michigan in 1963, 1964, and 1965, and of gulls in Lake Huron in 1965.

Kaufmann and co-workers in studies with captive ring-billed gulls at Michigan State University demonstrated that gulls may be made sick with oral administrations of toxic laboratory cultures of *C. botulinum* Type E.

Fish was the predominant food in the gizzards of 149 loons, 28 gulls, 16 grebes, and 2 mergansers examined by the Michigan Department of Conservation. It occurred in 95 percent, 100 percent, 81 percent, and 100 percent of the respective bird groups.

The Conservation Department conducted small-scale feeding experiments in which Great Lakes fish were fed to captive ring-billed gulls. Gulls fed dead alewives picked up on a Lake Michigan beach in June, 1965, developed symptoms of botulism. Type E toxin was identified in the blood of the gulls during the symptomatic period, but not in prefeeding and postrecovery blood samples, indicating it was Type E toxin that made the experimental birds sick.

Similar feedings of live-caught alewives, suckers, and yellow perch from northern Lake Michigan to captive ring-billed and herring gulls did not induce symptoms of botulism.

The results of limited feeding experiments indicate that dead fish, particularly alewives, which accumulate in considerable quantities in the water and on the beach, may be a direct source of toxin to gulls.

The means by which loons, grebes, and mergansers, which are not known to eat dead fish, get the toxin is totally unexplained.

## ACKNOWLEDGMENTS

I am grateful for assistance from U.S. Fish and Wildlife Service Game Management Agents W. G. McClure and R. J. Meyerding in

obtaining gulls for experimental feedings, to Dr. C. T. Black who reviewed this paper and made numerous helpful suggestions, and to my many Conservation Department colleagues who made specimens and field data available to me and assisted in investigations in many other ways. Particular thanks go to R. A. Bonar, student conservation aide, who so ably assisted in the laboratory studies.

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## PESTICIDES AND THE ENVIRONMENT— A PANEL DISCUSSION

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### LEVELS OF INSECTICIDE RESIDUES IN FISH AND WILDLIFE IN CALIFORNIA

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Recent scientific and semi-popular writings have aroused great interest in the ecological ramifications of the use of pesticides. Conservation groups have been especially concerned and numerous public agencies are currently conducting research to define the scope and degree of pesticide involvements with wildlife.

Several sources of corroborative evidence are frequently used to evaluate specific wildlife-pesticide relationships. Residue analyses have often been the most important aspect of such investigations. Documented responses in animals coupled with residue analyses of wildlife and their environment, and pertinent toxicological data have in several cases rather conclusively demonstrated effects of pesticide treatments on wildlife (Croker and Wilson, 1965; Hitchcock, 1965; Rosene, 1965; Wurster *et al.*, 1965; and Allison *et al.*, 1964).

Some of the complexities of pesticide-wildlife relationships have been demonstrated in residue studies involving animal food chains (Barker, 1958; Hunt and Bischoff, 1960; Burdick *et al.*, 1964; and Stickel *et al.*, 1965). Residue analyses of ecologically related components have often initially suggested the biological pathways of pesticide transfer and accumulation in complicated ecosystems.

Numerous investigations of pesticide-wildlife relations have been conducted in California by the Department of Fish and Game and the Bureau of Sport Fisheries and Wildlife. The Department has been involved in such studies since 1952, and in 1961 the Bureau began cooperative work in California. Various approaches have been followed in these investigations, but most have depended, at least in part, upon residue analyses. Between 1963 and 1965, the two agencies collected over 2100 samples for residue analyses. Many of these samples containing similar materials were composited, but over 1200 analyses were made for pesticide residues. Results were compiled and are presented here to summarize the relative contamination existing in some 86 species of wildlife and in their environments.

This information identifies the pesticides that are now known to occur commonly in wildlife and shows the components of the envi-

ronment and the species of wildlife that contain greatest residues. It also suggests the ecological affinities that exist between contaminated components of certain habitats. Knowledge of these relationships may prove especially helpful in assessing and understanding pesticide-wildlife involvements (Moore, 1965).

#### SOURCE OF SAMPLES

Samples were obtained of fish and wildlife and their environments from throughout California. Animals sampled undoubtedly had quite different exposures to pesticides. However, most were gathered from areas where pesticide contaminations and wildlife problems were thought to exist.

Various materials were often collected for analysis where pesticides were implicated in an unusual mortality of wildlife. The presence or absence of residues was usually an important factor in determining the role of pesticides in the mortality. Samples were also gathered during evaluations of side effects on fish and wildlife resulting from the operational use of pesticides in agriculture, forestry and mosquito control. Many analyses were made to determine the fate and persistence of pesticides in treated or contaminated habitats and to determine the effect of these residues on certain animals. Still other samples were obtained during surveys to determine if key species could be identified in which residue levels would reflect maximum amounts of insecticides occurring in various ecosystems.

#### ANALYSIS OF SAMPLES

Samples were examined by several laboratories, each using somewhat different techniques for the recovery, identification and quantification of pesticides. Most analyses were made by gas chromatography using either microcoulometric or electron capture detectors; some were made by paper chromatography. In general, pesticides were more difficult to recover from animal tissues than from vegetation and water. Adipose tissue, eggs and soils offered particular problems in sample clean-up.

Analyses were made primarily to detect chlorinated hydrocarbon insecticides. Therefore, residues of herbicides, fungicides and other classes of insecticides were not reported except in two cases where analyses for parathion and strychnine were made. In some instances the method of analysis for chlorinated hydrocarbons did not permit the detection of endrin, aldrin and dieldrin. The various isomers and metabolites of DDT were reported separately in some analyses. In others one figure was given for DDT and its breakdown products. Some procedures also changed, to an unknown degree, the relative

proportions of DDT and its metabolites in samples. Peterson and Robison (1964) have discussed the identity and relationships of the various metabolites of DDT.

Results, expressed in ppm (parts per million) of insecticides, are based on the wet weights of animal tissues; most soils, vegetation and commercial trout foods were air-dry when analyzed. Traces shown in tables indicate the presence of less than .006 ppm of an insecticide, except in water where a trace indicates less than .006 ppb (parts per billion).

#### RESULTS

In California, waters from throughout the state contained traces of persistent insecticides. Water courses are not frequently treated with persistent pesticides but may be contaminated by drainage from treated land areas. Flowing water apparently can serve as a mechanism for transport of residues from treated areas into untreated wildlife habitats. Exceedingly small amounts of insecticide in water have often been the source of much higher concentrations found in fish and wildlife and even minute residues in water must be regarded as potentially hazardous to animals dependent on aquatic or wetland environments (Hunt and Bischoff, 1960; Butler and Springer, 1963; Allison *et al.*, 1964).

Table 1 shows residues present in 82 water samples obtained from marshes, irrigation canals, streams, rivers and lakes. Low levels of insecticides were detected in over 80 percent of the samples. Thirty-three of these samples were filtered through No. 1 Whatman paper, and analyses were made of both filtrate and the particulate matter collected on filter papers. Insecticide concentrations on particulate matter ranged up to 78 ppm and were 10,000 to 100,000 times as high as those in the filtrate. These findings are of interest because organic portions of the suspended material undoubtedly serve as a basic source of energy for the lower trophic levels in aquatic food chains. Adherence to particulate matter may be of major importance in transferal of residues to higher forms of wildlife. Most bottom sediments contained much lower levels of insecticides than did particulate matter in water; exceptions occurred only in samples from a single area where levels of 94 ppm were found in bottom sediments.

Three wildlife habitats were sampled during special studies to depict the levels and persistence of chlorinated hydrocarbon residues in environments where input of pesticides was either known or measured (Table 2). Results of these studies suggested that, for terrestrial wildlife, contaminated foods are probably the most impor-



Table 1. Summary of insecticide residues found in water, in particulate matter filtered from water, and in bottom sediments from aquatic habitats

Attributes	No. of Samples Analyzed	Average Residues (ranges in parentheses)					
		DDT <u>a/</u>	BHC <u>b/</u>	Toxaphene	Dieldrin <u>c/</u>	Methoxychlor	Heptachlor Epoxide
----- parts per billion -----							
Water	82	0.62 (0.00-22.00)	0.01 (0.00-0.15)	0.02 (0.00-0.32)	T	0.00	T
----- parts per million -----							
Particulate matter <u>d/</u> in water	33	14.74 (1.80-78.00)	0.00	0.00	0.00	0.00	0.00
Bottom sediments	39	4.44 (0.01-94.00)	T	0.03 (0.00-0.30)	T	T	T

a/ Includes DDE, DDD, and DDMU.

b/ Some reported as BHC and/or lindane.

c/ Some reported as dieldrin and/or kelthane.

d/ In all filtered samples, filtrate also contained only DDT.

Table 2. Summary of insecticide residues found in various attributes from three wildlife habitats

Habitats <sup>1/</sup> & Attributes	No. of Samples <sup>2/</sup>	No. of Analyses	Average Residues in parts per million (ranges in parentheses)	
			DDT <sup>3/</sup>	DDE
<b>Marshes</b>				
Pondweed <sup>4/</sup>	13	13	5.73 (0.00-59.30)	0.33 (0.00-1.30)
Invertebrates <sup>5/</sup>	10	10	1.37 (0.00-10.00)	1.28 (0.00-5.00)
<b>Upland</b>				
Soil	6	6	2.00 (0.05-9.00)	0.03 (0.05-0.60)
Grasses	6	6	28.8 (0.50-110.0)	0.14 (0.05-0.40)
Shrubs	6	6	50.0 (1.70-200.0)	0.15 (0.10-0.40)
<b>Forest</b>				
Soil	40	8	0.40 (0.01-1.10)	0.18 (0.00-0.70)
Litter	40	8	7.00 (0.06-21.40)	0.28 (0.00-0.70)
Grasses	40	8	7.10 (0.03-24.80)	0.11 (0.00-0.70)
Forbs	40	8	2.46 (0.00-7.30)	0.18 (0.00-0.70)
Sagebrush	40	8	4.13 (0.00-15.80)	0.40 (0.00-1.20)
Fir foliage	40	8	2.06 (0.01-6.80)	0.09 (0.00-0.50)
Insects <sup>6/</sup>	3	3	81.13 (1.00-173.00)	16.13 (0.90-27.20)

<sup>1/</sup> Marshes not treated but received contaminated water. Upland treated annually for 15 years with 1 lb/acre DDT; and forest treated once with 3/4 lb/acre DDT; samples obtained before and after 1964 treatments.

<sup>2/</sup> Some samples composited for analysis.

<sup>3/</sup> Includes DDD and DDMU.

<sup>4/</sup> Traces of dieldrin and methoxychlor present in three samples.

<sup>5/</sup> Trace of toxaphene present in one sample.

<sup>6/</sup> Insects collected in drop cloths 1 day, 2 days and 1 month after spraying.

tant route of exposure to chlorinated hydrocarbon insecticides. Residues in water offer a hazard to fish from direct absorption as well as that presented by pesticide-contaminated food (Allison *et al.*, 1964).

Untreated marsh areas subjected to contamination from waste agricultural water showed that residues averaging 1 to 5 ppm had been transferred to pondweeds and invertebrates, both of which serve as foods for fish and wildlife. An arid upland site treated annually for 15 years with 1 pound per acre of DDT was sampled several times between 1963 and 1965. High residues in soil and plants were detected immediately after spraying, but subsequent samples contained only low residues. In an untreated coniferous forest, traces of DDT occurred in some of the various materials

Table 3. Summary of insecticide residues found in upland game animals

Species & Tissues	No. of Samples Analyzed	Average Residues in parts per million (ranges in parentheses)		
		DDT	DDE	DDD
<b>Pheasant</b>				
Fat <sup>a/</sup>	146	57.82 (0.00-2768.00)	65.29 (0.15-2680.00)	0.01 (0.00-0.67)
Muscle	22	0.55 (0.00-3.70)	1.35 (0.06-12.00)	0.00
Liver	10	0.00	0.47 (0.13-0.60)	0.06 (0.02-0.18)
<b>Valley quail</b>				
Liver <sup>b/</sup>	2	0.00	0.80 (0.00-1.60)	0.09 (0.00-0.18)
Brain	1	0.00	0.00	0.00
Crop	1	0.00	0.56	0.00
<b>Cottontail</b>				
Liver	1	0.10	0.10	0.00
Muscle	1	0.10	0.10	0.00
<b>Jackrabbit</b>				
Liver	1	0.10	0.10	0.00
Muscle	1	0.10	0.10	0.00

<sup>a/</sup> Average of 0.84 ppm dieldrin also present.

<sup>b/</sup> Average of 10.00 ppm aldrin and 9.00 ppm arsenic trioxide also present.

Table 4. Summary of insecticide residues found in big game animals

Species & Tissues	No. of Samples Analyzed	Average Residue in parts per million (ranges in parentheses)		
		DDT	DDE	DDD
Tule elk				
Fat	2	0.95 (0.80-1.10)	13.00 (9.00-17.00)	0.28 (0.10-0.45)
Mule deer				
Fat	1	0.25	0.07	0.07

collected. Residues increased greatly after treatment with  $\frac{3}{4}$  pound per acre of DDT, but levels generally decreased in six-week and three-month, post-treatment samples. In some physical substrates and some birds, high residues persisted for at least three months. Insects accumulated quite high levels of DDT before death and constituted an important source of exposure for insectivorous wildlife.

In Table 2 average residues from marshes represent levels to which migratory birds and other wildlife might be almost continuously exposed. Those from the upland and forest sites indicate means around which levels fluctuate in direct relation to insecticide treatments. Habitat contaminations appeared much more transitory in terrestrial than in marsh environments.

In California, pheasants contained higher insecticide residues than any other species of wildlife examined. DDT residues in fat of pheasants from a rice-growing area in the Sacramento Valley ranged up to 2768 ppm (Table 3). Studies in this area indicated that DDT residues were influencing reproductive success in wild pheasants (Hunt and Keith, 1963), and led to more detailed investigations of these relationships (Azevedo *et al.*, 1965). Insecticide levels were lower in pheasants from other areas of California, but under certain types of exposures the birds can apparently accumulate high residues of agricultural chemicals.

The few samples of big game that were analyzed showed that even animals resident in untreated habitats can accumulate residues of DDT (Table 4). Fat of animals from the captive herd of tule elk in the southern San Joaquin valley contained about 14 ppm of DDT and its metabolites.

Table 5. Summary of insecticide residues found in birds of prey and carrion feeders

Species & Tissues	No. of Samples Analyzed	Average Residue in parts per million (ranges in parentheses)		
		DDT	DDE	DDD
California condor				
Fat	2	16.00 (14.00-18.00)	25.00 (20.00-30.00)	0.00
Bald eagle				
Fat	1	1.00	60.00	0.60
Swainson's hawk				
Fat	1	1.00	38.00	0.43
Red-tailed hawk				
Egg yolk <sup>a/</sup>	2	4.34 (0.39-8.29)	55.65 (21.30-90.00)	0.12 (0.00-0.25)
Marsh hawk				
Egg yolk <sup>b/</sup>	1	0.95	4.27	0.00
Osprey				
Egg yolk <sup>c/</sup>	2	3.86 (3.48-4.25)	29.40 (23.90-34.80)	0.00
Sparrow hawk				
Egg yolk	2	0.58 (0.20-0.95)	0.71 (0.39-1.03)	0.00
Great horned owl				
Brain	1	T	0.30	0.00
Egg yolk	1	1.80	15.00	0.70
Long-eared owl				
Egg yolk	2	0.20 (0.16-0.25)	1.64 (0.58-2.70)	0.00
Magpie				
Egg yolk	1	0.38	0.90	0.21

<sup>a/</sup> Average of 0.68 ppm dieldrin also present.

<sup>b/</sup> Also contained 0.28 ppm dieldrin.

<sup>c/</sup> Average of 0.08 ppm dieldrin also present.

Birds of prey contained DDT, its metabolites and dieldrin (Table 5). Residues up to about 60 ppm were present in fat of most species and amounts were often in excess of those found in some of the birds' foods.

Songbirds were collected from a forested area before and periodically after treatment with DDT. Residues in insectivorous species increased steadily for three months after DDT applications to levels as high as 21 ppm in mountain chickadees; residues in other species also increased but returned to pretreatment levels during that period. Songbirds containing endrin, parathion and strychnine were from areas treated with those pesticides (Table 6).

All waterfowl samples contained residues but, in general, levels were somewhat lower than those in other birds using marshlands (Table 7). Geese, swans, and most dabbling ducks had relatively low levels of residues while birds more dependent on animal foods contained higher levels. The frequency with which dieldrin residues were found in some ducks and other water birds may reflect the chemicals rather common occurrence in water and wetland habitats.

Table 8 shows insecticide residues detected in various species of shorebirds. As a group, these birds contained high (10-70 ppm) and potentially hazardous levels of DDT residues. Much of their diet is animal matter obtained from wetlands; animal food chains in those habitats are apparently commonly contaminated with DDT (Keith, 1966).

Fish-eating birds of several species contained sizable residues in fat, eggs and other tissues (Table 9). A sufficient number of birds were examined to show that amounts of residues varied considerably between individuals of a species. Some birds found dead contained strikingly high amounts of DDT in addition to the more toxic compounds, dieldrin and toxaphene. Most birds shot, and a few of those found dead, had much lower residues. Toxaphene was shown to have caused mortality in several species of fish-eating birds in California between 1960 and 1962 (Keith, 1966).

Considering residue levels accumulated by fish-eating birds, it is not surprising that the fish they eat also contain concentrations of insecticides. Table 10 summarizes residues found in various species of warmwater fish. Fat often contained over 100 ppm in some fish. Residues in whole fish or flesh samples usually were less than 1 ppm and more closely represented amounts in diet of fish predators. Most of these fish were caught in sites subjected to contamination by waste agricultural water which was undoubtedly the primary source of insecticides found in the fish.

Table 6. Summary of pesticide residues found in song birds

Species <sup>a/</sup> & Tissues	No. of Samples <sup>b/</sup>	No. of Analyses	Average Residues in parts per million (ranges in parentheses)					
			DDT	DDE	Endrin	Parathion	Strychnine	
Robin								
Whole body	40	8	0.15 (0.02-0.50)	0.88 (0.01-4.60)	0.00	- <sup>c/</sup>	-	
Oregon junco								
Whole body	40	8	0.90 (0.01-2.41)	1.70 (0.10-7.18)	0.00	-	-	
Mountain chickadee								
Whole body	45	10	1.97 (0.08-5.90)	5.10 (0.30-21.30)	0.00	-	-	
Gray flycatcher								
Whole body	30	6	0.81 (0.02-2.50)	1.18 (0.20-3.50)	0.00	-	-	
Western tanager								
Whole body	15	3	0.75 (0.04-1.40)	0.60 (0.30-1.10)	0.00	-	-	
House finch								
Muscle	3	1	0.00	1.41	1.23	-	-	
Gizzard	3	1	0.00	0.96	1.45	-	-	
Various species								
Feathers	18	2	-	-	-	0.17 (0.00-0.50)	-	
Crop	4	1	-	-	-	-	present	

<sup>a/</sup> Robins, juncos, chickadees, flycatchers, and tanagers collected before and up to three months after treatment of a forest habitat with 3/4 lb/acre of DDT.

<sup>b/</sup> Some samples composited for analysis.

<sup>c/</sup> Dash indicates analysis not specific for designated pesticide.

Table 7. Summary of insecticide residues found in waterfowl

Species & Tissues	No. of Samples Analyzed	Average Residues in parts per million (ranges in parentheses)				
		DDT	DDE	DDD	Dieldrin	Endrin
Mallard						
Fat	11	13.88 (0.00-80.00)	13.98 (0.42-70.00)	0.60 (0.00-4.40)	T	0.00
Egg yolk	14	0.57 (0.00-0.80)	2.12 (0.32-8.60)	0.03 (0.00-0.14)	0.05 (0.00-0.44)	0.00
Gadwall						
Fat <u>a/</u>	8	0.67 ( T -5.00)	3.56 ( T -28.00)	0.58 (0.10-4.20)	T	0.00
Liver <u>a/</u>	4	0.01 ( T -0.02)	0.03 ( T -0.05)	0.00	0.05 ( T -0.17)	T
Flesh <u>b/</u>	3	T	T	0.00	T	0.00
Egg yolk <u>c/</u>	5	0.13 (0.00-0.25)	0.62 (0.01-1.41)	0.00	0.02 (0.00-0.05)	T
American widgeon						
Fat <u>d/</u>	2	0.00	0.04 (0.00-0.07)	0.04 (0.00-0.09)	0.00	0.00
Pintail						
Fat	2	1.41 (0.00-2.83)	7.21 (0.09-14.33)	0.32 (0.00-0.65)	0.39 (0.24-0.54)	0.00
Shoveler						
Fat	1	0.21	0.55	0.00	0.00	0.00
Cinnamon teal						
Fat <u>b/</u>	5	15.81 (0.00-77.90)	7.59 (2.19-27.18)	0.07 (0.00-0.36)	0.06 (0.00-0.32)	0.00
Egg yolk <u>e/</u>	7	0.71 (0.06-3.50)	12.06 (0.43-62.50)	0.00	0.07 (0.00-0.16)	0.00



Table 7. (continued)

Green-winged teal						
Fat	2	6.14 (4.43-7.84)	9.89 (7.59-12.20)	3.35 (1.60-5.11)	0.00	0.00
Canvasback						
Fat	4	2.88 (0.00-5.40)	54.41 (15.63-170.00)	2.10 (0.00-5.00)	0.00	0.00
Lesser scaup						
	8	7.34 (1.20-27.60)	13.85 (1.50-54.16)	5.71 (0.50-21.28)	0.00	0.00
Redhead						
Fat	2	0.04 (0.00-0.07)	0.04 (0.02-0.06)	0.00	0.00	0.00
Egg	1	0.94	0.73	0.00	0.17	0.00
Ruddy duck						
Fat	1	1.08	2.07	0.45	0.00	0.00
American coot						
Fat	1	2.10	3.90	0.00	0.00	0.00
Egg yolk	6	1.06 (0.00-3.70)	6.70 (0.14-19.20)	0.00	0.34 (0.00-0.97)	0.07 (0.00-0.30)
White-fronted goose						
Fat	3	1.82 (1.29-2.82)	0.60 (0.21-0.85)	0.00	0.10 (0.06-0.14)	0.03 (0.00-0.10)
Whistling swan						
Fat	2	0.84 (0.18-1.50)	0.38 (0.07-0.70)	0.00	0.04 (0.00-0.08)	0.00

a/ Traces of chlordane and heptachlor epoxide also present in fat and liver samples.

b/ Trace of heptachlor epoxide also present.

c/ Average of 0.04 ppm toxaphene also present.

d/ Average of 0.39 ppm aldrin also present.

e/ Traces of thiodan and heptachlor epoxide also present.

Table 8. Summary of Insecticide residues found in shorebirds

Species & Tissues	No. of Samples	No. of Analyses	Average Residues in parts per million (ranges in parentheses)			
			DDT	DDE	DDD	Dieldrin
Killdeer						
Egg yolk	3	1	1.40	25.00	0.00	0.00
Black-bellied plover						
Fat	1	1	4.10	14.00	1.60	0.00
Long-billed curlew						
Fat	1	1	15.26	32.09	22.80	0.00
Willet						
Fat	1	1	9.45	25.00	18.70	0.00
Liver-Kidney	3	1	1.04	1.59	0.48	0.22
Least sandpiper						
Fat	1	1	18.00	2.40	0.85	0.00
Liver	6	2	0.24 (0.16-0.31)	0.98 (0.71-1.25)	0.60 (0.58-0.61)	0.27 (0.00-0.54)

Table 8. (continued)

Dunlin						
Fat	1	1	1.30	5.20	0.40	0.00
Short-billed dowitcher						
Fat	3	3	19.62 (0.00-45.45)	24.55 (1.90-50.76)	24.78 (0.00-67.34)	0.00
Liver	1	1	1.63	1.80	1.00	0.36
Marbled godwit						
Fat	1	1	8.70	12.93	5.83	1.51
American avocet						
Fat	4	4	2.53 (0.00-5.22)	10.81 (9.50-12.72)	0.52 (0.00-0.85)	0.00
Egg yolk	7	2	1.58 (0.00-3.15)	3.08 (1.60-4.55)	0.00	0.04 (0.00-0.09)
Black-necked stilt						
Egg yolk <sup>b/</sup>	8	8	0.66 (0.00-2.20)	10.45 (4.82-34.00)	0.28 (0.00-2.20)	0.53 (0.00-3.66)

<sup>a/</sup> Some samples composited for analysis.

<sup>b/</sup> Average of 0.05 ppm endrin also present.

Table 9. Summary of insecticide residues found in fish-eating birds

Species & Tissues	No. of Samples Analyzed <sup>a/</sup>	Average Residues in parts per million (ranges in parentheses)					
		DDT	DDE	DDD	Dieldrin	Toxaphene	Heptachlor Epoxide
<b>White pelican</b>							
Fat	19	0.84 (0.00-4.90)	39.18 (1.20-182.00)	12.65 (0.34-78.00)	3.42 ( T -32.00)	0.00	T
HLKM <sup>b/</sup>	49	0.05 (0.00-1.72)	17.61 (0.34-194.00)	6.68 (0.08-53.00)	0.93 (0.00-10.40)	3.60 (0.00-82.00)	T
Brain	25	T	1.93 (0.15-24.40)	0.59 (0.00-7.40)	0.25 (0.00-3.00)	0.00	T
Liver	3	0.00	21.00 (0.00-64.00)	9.33 (6.00-15.00)	0.00	8.00 (7.00-9.00)	0.00
Kidney	3	0.00	8.00 (0.00-24.00)	9.00 (7.00-12.00)	0.00	10.33 (4.00-14.00)	0.00
Testis	1	0.00	0.35	T	T	0.00	0.00
Ovary	7	0.26 (0.00-1.85)	8.87 (0.32-28.20)	3.24 (0.40-10.95)	1.51 (0.00-7.60)	0.00	T
Egg	22	0.07 (0.00-0.77)	1.48 (0.10-7.90)	0.67 ( T -2.20)	0.20 (0.00-1.90)	0.39 (0.00-6.70)	T
Nestlings	6	0.07 (0.00-0.20)	1.42 (0.43-2.30)	0.48 (0.13-0.95)	0.16 (0.02-0.33)	0.00	0.00
<b>Double-crested cormorant</b>							
Whole body	2	0.00	13.20 (2.40-24.00)	0.00	0.00	5.80 (2.20-9.50)	0.00
Egg yolk	2	7.56 (3.13-12.00)	27.20 (12.00-42.00)	0.00	0.00	10.00 (0.00-20.00)	0.00

Table 9. (continued)

<b>Black tern</b>							
Whole body	1	0.00	3.50	0.00	0.00	0.00	0.00
<b>Forster's tern</b>							
Whole body	1	1.00	24.00	1.00	0.00	0.00	0.00
Egg yolk	1	0.00	35.00	0.00	0.07	15.50	0.00
<b>Caspian tern</b>							
Egg yolk <sup>c/</sup>	2	1.68 (0.59-2.76)	2.54 (0.69-4.39)	0.00	0.02 (0.01-0.02)	0.00	0.00
<b>Ring-billed gull</b>							
Fat	1	1.00	20.40	0.00	0.30	4.80	0.00
HLKMB	2	0.00	5.45 (1.30-9.60)	0.00	0.00	0.00	0.00
Egg yolk <sup>d/</sup>	1	1.90	6.80	0.00	0.94	0.20	0.60
<b>California gull</b>							
HLKMB	3	0.00	18.07 (1.30-36.00)	0.00	0.00	0.00	0.00
<b>Eared grebe</b>							
Whole body	5	0.00	0.10 ( T -0.50)	0.00	0.00	1.90 (0.00-4.00)	0.00
<b>Pied-billed grebe</b>							
Egg yolk	1	0.78	4.47	0.00	0.00	0.00	0.00

Table 9. (continued)

Western grebe							
Fat	5	0.07 (0.00-0.16)	102.24 (0.06-348.00)	81.80 (0.00-302.00)	0.00	12.66 (0.00-39.00)	0.03 (0.00-0.10)
Whole body	8	T	22.81 (6.00-38.00)	38.10 (0.00-240.00)	0.04 (0.00-0.36)	0.02 (0.00-0.80)	0.00
Brain	1	0.00	9.83	4.63	T	0.00	T
Common egret							
Whole body	4	17.45 (0.00-63.00)	51.75 (40.00-69.00)	18.50 (0.00-52.00)	0.00	6.92 (0.00-17.00)	0.00
Liver	1	0.76	47.50	15.70	0.00	0.00	0.00
Egg yolk	3	10.76 (1.30-38.50)	25.43 (8.30-76.30)	0.43 (0.00-1.30)	0.08 (0.00-0.24)	0.00	0.00
Great blue heron							
Whole body	1	0.00	3.00	0.00	0.00	10.00	0.00
Egg	1	0.00	8.20	T	0.26	0.00	0.00
Black-crowned night heron							
Whole body	3	0.00	11.33 (4.00-18.00)	0.00	0.00	5.00 (0.00-15.00)	0.00
Egg yolk	4	1.48 (0.00-2.51)	50.78 (8.21-110.00)	0.00	0.83 (0.00-2.26)	0.00	0.00

a/ Most egg samples contained several whole eggs.

b/ Composite of 5 grams each of heart, liver, kidney, breast muscle and brain as designated by H, L, K, M and B, respectively; traces of endrin also present.

c/ Also, trace of endrin present.

d/ Also, 0.50 ppm of BHC present.

Table 10. Summary of insecticide residues found in warmwater forage and game fishes

Species & Tissues	No. of Samples <sup>a/</sup>	No. of Analyses	Average Residues in parts per million (ranges in parentheses)				
			DDT	DDE	DDD	Dieldrin	Toxaphene
<b>Largemouth bass</b>							
Flesh <sup>b/</sup>	13	13	0.17 (0.01-0.58)	0.32 (0.04-0.80)	1.48 (0.45-5.00)	0.01 (0.00-0.02)	0.05 (0.00-0.30)
Viscera <sup>b/</sup>	8	8	7.66 (0.68-24.00)	11.18 (0.26-41.00)	0.00	0.05 (0.02-0.10)	1.13 (0.20-2.00)
Ova	1	1	0.29	6.00	26.00	0.00	0.00
Whole fish <sup>c/</sup>	1	1	0.00	0.08	0.02	0.06	0.00
<b>Black crappie</b>							
Whole fish	6	3	0.03 (0.00-0.10)	0.08 (0.02-0.11)	0.09 (0.01-0.20)	0.02 (0.00-0.06)	0.03 (0.00-0.10)
<b>Pumpkinseed</b>							
Whole fish <sup>c/</sup>	4	1	0.00	0.04	0.02	0.01	0.04
<b>Channel Catfish</b>							
Fat <sup>c/</sup>	9	8	27.52 (4.10-78.86)	92.79 (23.40-269.00)	106.40 (19.77-212.00)	0.24 (0.00-1.88)	0.00
Flesh	18	11	0.48 (0.00-3.47)	1.84 (0.00-16.00)	1.70 (0.00-13.77)	0.00	0.00
Brain	7	3	1.66 (0.96-2.53)	3.36 (0.51-8.78)	3.30 (0.74-7.88)	0.00	0.00
Ova	2	2	0.90 (0.55-1.25)	12.29 (2.53-22.00)	10.42 (4.00-16.85)	0.00	0.00
<b>White catfish</b>							
Fat <sup>d/</sup>	19	13	145.80 (7.25-455.00)	275.22 (0.00-1392.00)	196.57 (0.00-758.00)	3.03 (0.00-11.50)	0.00
Flesh	1	1	0.09	0.60	0.32	0.00	0.00
Ova	2	2	6.50 (3.00-10.00)	44.00 (28.00-60.00)	12.00 (10.00-14.00)	0.00	0.00

Table 10. (continued)

Brown bullhead							
Fat	6	6	1.90 (0.69-4.86)	5.20 (2.45-11.54)	6.32 (2.83-15.89)	0.40 (0.00-1.30)	0.00
Flesh	14	3	0.14 (0.06-0.23)	0.36 (0.17-0.50)	0.00	0.00	0.06 (0.00-0.19)
Ova	2	2	0.79 (0.05-1.52)	0.45 (0.03-0.87)	0.71 (0.05-1.36)	0.10 (0.00-0.21)	0.00
Whole fish	1	1	0.00	0.11	0.08	0.00	0.00
Black bullhead							
Flesh	1	1	0.43	0.70	0.27	0.00	0.00
Yellow perch							
Whole fish	3	3	0.00	0.04 (0.02-0.07)	0.03 (0.01-0.07)	0.01 (0.00-0.02)	0.00
Carp							
Flesh	1	1	0.17	0.33	0.00	0.00	0.10
Viscera	4	2	8.80 (5.00-12.60)	4.45 (0.00-8.90)	0.00	0.03 (0.00-0.06)	0.05 (0.00-0.10)
Tui chub							
Whole fish <sup>c/</sup>	337	29	T	0.07 (0.00-1.80)	0.04 (0.00-0.20)	0.01 (0.00-0.04)	1.09 (0.00-8.00)
Sacramento blackfish							
Flesh	2	1	0.00	0.75	0.37	0.00	0.00
Hard head							
Flesh	1	1	0.00	0.25	0.15	0.00	0.00

a/ Some samples composited for analysis.

b/ Traces of BHC and heptachlor epoxide also present in some samples.

c/ Traces of endrin also present in some samples.

d/ Also, 5.1 and 4.00 ppm endrin detected in two samples.



Table 11. Summary of insecticide residues found in rainbow and steelhead trout

Species & Tissues	No. of Samples <sup>a/</sup>	No. of Analyses	Average Residues in parts per million (ranges in parentheses)				
			DDT	DDE	DDD	Dieldrin	Toxaphene
<b>Rainbow</b>							
Fat	90	14	5.74 (0.41-9.14)	3.10 (0.15-6.10)	0.33 (0.00-1.34)	0.02 (0.00-0.06)	0.00
Flesh <sup>b/</sup>	41 <sup>c/</sup>	19	0.08 (0.00-0.72)	0.07 (0.00-0.22)	0.02 (0.03-0.11)	T	0.22 (0.00-2.57)
Brain	53	5	0.10 (0.00-0.25)	0.10 (0.00-0.18)	0.05 (0.00-0.17)	0.00	0.00
Liver	5	1	0.18	0.11	0.06	0.00	0.00
Ova	2	2	0.21 (0.07-0.37)	0.09 (0.03-0.16)	0.08 (0.00-0.16)	0.00	0.00
<b>Steelhead</b>							
Fat	1	1	0.00	1.60	0.00	0.00	0.00
Ova	1	1	0.00	0.06	0.00	0.00	0.00

<sup>a/</sup> Some samples composited for analysis.

<sup>b/</sup> Trace of heptachlor epoxide also present in some samples

<sup>c/</sup> Includes two samples of brown trout.

Table 12. Summary of insecticide residues found in commercial fish pellets fed to hatchery trout <sup>a/</sup>

Insecticides	Residues in parts per million	
	Averages	Ranges
DDT	0.07	0.00-0.83
DDE	0.04	0.00-0.20
DDD	0.02	0.00-0.18
BHC	T	0.00-0.04
Lindane	0.01	0.00-0.22
Dieldrin	0.01	0.00-0.08
Toxaphene	0.01	0.00-0.48
Heptachlor epoxide	0.01	0.00-0.04
Ethion	0.01	0.00-0.23
Parathion	0.01	0.00-0.24

<sup>a/</sup> Fifty-six analyses were made of pellets from eight different sources of supply.

Insecticides found in trout and steelhead are shown in Table 11. Most samples contained some residues of DDT, dieldrin, toxaphene or heptachlor epoxide. Samples of trout were obtained mainly from hatcheries where exposure most likely occurred in food provided for fish. Analyses of eight brands of commercial trout foods showed that diets fed to hatchery trout contained small amounts of a variety of insecticides (Table 12).

All anadromous fish examined contained residues of chlorinated hydrocarbon insecticides (Table 13). Levels in king salmon were low, while much higher concentrations were found in striped bass. Differences in residues in these two species may reflect differences in feeding habits and exposure to insecticides. Adult salmon feed almost exclusively in the ocean while adult striped bass also feed in inland waters where foods probably contain greater contaminations. Residues in three bass, whose stomachs contained 2- to 3-inch carp, averaged 111.0 ppm DDT and 3.2 ppm dieldrin in whole fish. The carp taken from bass stomachs averaged 1.40 ppm DDT, 0.06 ppm dieldrin, and 0.50 ppm toxaphene.

A survey of residues in shellfish collected in coastal bays of California from Morro to Humboldt Bay showed that clams, oysters

Table 13. Summary of insecticide residues found in king salmon and striped bass

Species & Tissues	No. of Samples <sup>a/</sup>	No. of Analyses	Average Residues in parts per million (ranges in parentheses)				
			DDT	DDE	DDD	Dieldrin	Endrin
King salmon							
Fat	2	2	0.18 (0.00-0.32)	1.11 (1.00-1.22)	0.16 (0.00-0.33)	0.00	0.00
Flesh	16	13	0.12 (0.02-0.42)	0.39 (0.06-0.94)	0.10 (0.02-0.33)	0.00	0.00
Ova	11	8	0.04 (0.00-0.18)	0.40 (0.20-0.80)	0.04 (0.00-0.09)	0.00	0.00
Caecum	1	1	0.00	0.30	0.00	0.00	0.00
Striped bass							
Fat	136	39 <sup>b/</sup>	19.64 (2.76-80.00)	26.15 (2.40-124.20)	14.82 (1.61-48.56)	0.75 (0.00-7.10)	0.09 (0.00-1.90)
Flesh	6	3	0.17 (0.00-0.30)	0.17 ( T -0.30)	0.00	0.00	0.00
Ova	17	7	1.79 (0.80-2.67)	2.64 (0.97-5.05)	1.39 (0.69-2.00)	0.00	0.00

<sup>a/</sup> Some samples composited for analysis.<sup>b/</sup> 3.0 ppm aldrin also detected in one composite sample.

Table 14. Summary of DDT residues found in flesh of shellfish

Species	No. of Samples Analyzed <sup>a/</sup>	Average DDT Residues in parts per million (ranges in parentheses)	
Common Washington clam	4	0.05 (0.00-0.20)	
Common littleneck clam	6	0.23 (0.00-1.39)	
Japanese littleneck clam	1	0.00	
Bent-nose clam	1	0.00	
Gaper clam	4	0.00	
Giant Pacific oyster	10	0.17 (0.00-0.68)	
Rock scallop	1	0.16	

<sup>a/</sup> All samples contained several to numerous individual animals.

Table 15. Summary of insecticide residues found in various other animal species

Species & Tissues	No. of Samples <sup>a/</sup>	No. of Analyses	Average Residues in parts per million (ranges in parentheses)	
			DDT	DDE
Deer mouse	20	4	0.09 (0.05-0.20)	0.04 (0.02-0.08)
Antelope ground squirrel				
Muscle	3	1	0.10	0.10
Roadrunner				
Fat	2	2	0.25 (0.20-0.30)	2.10 (0.90-3.30)
Brain	2	1	0.10	0.10
Softshell turtle				
Fat	1	1	32.00	700.00
Flesh	1	1	0.43	8.00
Viscera <sup>b/</sup>	1	1	3.70	12.50

<sup>a/</sup> Some samples composited for analysis.

<sup>b/</sup> Also present were 3.5 ppm dieldrin, 1.0 ppm toxaphene and 1.10 ppm heptachlor epoxide.

and scallops had accumulated low levels of DDT (Table 14). Pesticides carried into the ocean by rivers are undoubtedly an important source of contamination of these filter feeders.

Table 15 shows DDT residues found in deer mice, antelope ground squirrels, roadrunners and a softshell turtle. Only the turtle contained high residues; 732 ppm of DDT and its metabolites were present in body fat.

#### DISCUSSION

Residues as summarized show sample incidences of pesticide residues in California's fish and wildlife and their environments. In some cases studies have related residues to specific uses of pesticides. Much of the data was obtained from general survey investigation and can not be associated with any particular program of pesticide use. However the nature and levels of various residues have provided information on the kinds of pesticides and wildlife that may deserve special attention.

Analytical findings presented in Tables 1 through 15 show that wildlife, their foods and physical environments are widely contaminated with insecticide residues. DDT residues are omnipresent and occur with much greater frequency and in greater average amounts than any other insecticide for which analytical techniques were sensitive. Dieldrin, toxaphene, endrin, BHC, and heptachlor epoxide were also frequently encountered in samples.

DDT has a relatively low toxicity to birds and mammals, and wildlife mortality has occurred only when animals were exposed to large amounts of the insecticide. Only one incidence has been reported of DDT affecting avian or mammalian reproduction under field conditions (Hunt and Keith, 1963); this occurred when pheasants were exposed in diet to several thousand ppm of DDT on rice seed. In contrast to birds and mammals, fish are highly susceptible to DDT poisoning. Part per billion concentrations in water have been shown to affect behavior, reproduction and mortality in trout (Allison *et al.*, 1964; Burdick *et al.*, 1964). Shellfish also are apparently quite susceptible to DDT; growth, reproduction and mortality can be influenced by only several ppb in water (Butler and Springer, 1963). Dieldrin, toxaphene, endrin, and heptachlor are highly toxic to both warm-blooded vertebrates and aquatic animals.

Residues in tissues can not yet be used with confidence to diagnose either the intensity of exposure or the effects of pesticides on wild animals. Deposition of residues in tissues is influenced by many factors such as the rate of ingestion, assimilation, degradation and excretion of pesticides by the animal. The influence of the interaction of these factors on the deposition of residues in an

animal's system is not clearly understood. Several workers have demonstrated a close relationship between levels of tissue residues, symptoms of intoxication, and death in animals under controlled experimental conditions (DeWitt *et al.*, 1955; Dale *et al.*, 1962; Bernard, 1963; and Azevedo *et al.*, 1965). These results have also been used to interpret effects observed in certain species exposed under field conditions (DeWitt *et al.*, 1955; Wurster *et al.*, 1965). It may be possible to establish a range of residue levels in certain tissues that are diagnostic of the intensity of insecticide effects on wildlife. However, such experimentation should take into account the variations in physiological condition and exposure to which wildlife are subjected under field conditions. Such criteria must also be developed for each species as animals vary considerably in their susceptibility to specific insecticides.

Wildlife dependent upon aquatic and wetland habitats appear to receive greater exposures to insecticides than terrestrial animals. Residues in tissues may reflect these differences in exposure. Terrestrial species are sometimes subjected to high contaminations after treatment of their habitats, but levels in most cases apparently decline relatively soon after applications. Aquatic habitats sampled have rather consistently contained greater average levels of contamination than terrestrial habitats. Exceptions do occur, as in the leaf litter-earthworm-robin-DDT relationships described by Barker (1958), and the rice seed-pheasant-DDT studies in California.

Contaminations of food appear to be the primary source of exposure for most wildlife species and variations in tissue residues between species probably represent differences in contaminations of their foods. Insecticides exhibit affinities for certain components in environments to which they are applied; residues also persist longer on some substrates than others. Organisms closely associated with or dependent upon contaminated substrates are likely to accumulate residues and thereby enable transfer of insecticides to other animals for which they serve as a food source. Wildlife species at various trophic levels of such food chains can serve as carriers of residues and may themselves be debilitated by the effects of the insecticides.

Studies of pesticide involvements in natural communities are sorely needed to depict the biological effects of the compounds on ecologically related organisms. Residue analyses will be an essential part of those studies. Knowledge of residue levels in various animals and physical substrates from treated or contaminated environments often offers the best possibility for initial assessment of pesticide effects. The greatest value of analyses reported here may be in directing the initial course of such future research.

## LIST OF SPECIES

*Mammals*

San Joaquin antelope squirrel	<i>Citellus nelsoni</i>
Deer mouse	<i>Peromyscus maniculatus</i>
Desert cottontail	<i>Sylvilagus auduboni</i>
Blacktail jackrabbit	<i>Lepus californicus</i>
Tule elk	<i>Cervus nannodes</i>
Mule deer	<i>Odocoileus hemionus</i>

*Birds*

Eared grebe	<i>Podiceps caspicus</i>
Western grebe	<i>Aechmophorus occidentalis</i>
Pied-billed grebe	<i>Podilymbus podiceps</i>
White pelican	<i>Pelecanus erythrorhynchos</i>
Double-crested cormorant	<i>Phalacrocorax auritus</i>
Great blue heron	<i>Ardea herodias</i>
Common egret	<i>Casmerodius albus</i>
Black-crowned night heron	<i>Nycticorax nycticorax</i>
Whistling swan	<i>Olor columbianus</i>
White-fronted goose	<i>Anser albifrons</i>
Mallard	<i>Anas platyrhynchos</i>
Gadwall	<i>Anas strepera</i>
Pintail	<i>Anas acuta</i>
Green-winged teal	<i>Anas carolinensis</i>
Cinnamon teal	<i>Anas cyanoptera</i>
American widgeon	<i>Mareca americana</i>
Shoveler	<i>Spatula clypeata</i>
Redhead	<i>Aythya americana</i>
Canvasback	<i>Aythya valisineria</i>
Lesser scaup	<i>Aythya affinis</i>
Ruddy duck	<i>Oxyura jamaicensis</i>
California condor	<i>Gymnogyps californianus</i>
Red-tailed hawk	<i>Buteo jamaicensis</i>
Swainson's hawk	<i>Buteo swainsoni</i>
Bald eagle	<i>Haliaeetus leucocephalus</i>
Marsh hawk	<i>Circus cyaneus</i>
Osprey	<i>Pandion haliaetus</i>
Sparrow hawk	<i>Falco sparverius</i>
California quail	<i>Lophortyx californicus</i>
Ring-necked pheasant	<i>Phasianus colchicus</i>
American coot	<i>Fulica americana</i>
Killdeer	<i>Charadrius vociferus</i>
Black-bellied plover	<i>Squatarola squatarola</i>
Long-billed curlew	<i>Numenius americanus</i>
Willet	<i>Catoptrophorus semipalmatus</i>
Least sandpiper	<i>Erolia minutilla</i>
Dunlin	<i>Erolia alpina</i>
Short-billed dowitcher	<i>Limnodromus griseus</i>
Marbled godwit	<i>Limosa fedoa</i>
American avocet	<i>Recurvirostra americana</i>
Black-necked stilt	<i>Himantopus mexicanus</i>
California gull	<i>Larus californicus</i>
Ring-billed gull	<i>Larus delawarensis</i>
Forster's tern	<i>Sterna forsteri</i>
Caspian tern	<i>Hydroprogne caspia</i>
Black tern	<i>Chlidonias niger</i>
Roadrunner	<i>Geococcyx californianus</i>

Great horned owl	<i>Bubo virginianus</i>
Long-eared owl	<i>Asio otus</i>
Gray flycatcher	<i>Empidonax wrightii</i>
Yellow-billed magpie	<i>Pica nuttalli</i>
Mountain chickadee	<i>Parus gambeli</i>
Robin	<i>Turdus migratorius</i>
Western tanager	<i>Piranga ludoviciana</i>
House finch	<i>Carpodacus mexicanus</i>
Oregon junco	<i>Junco oreganus</i>

*Fish*

King salmon	<i>Onchorynchus tshawytscha</i>
Brown trout	<i>Salmo trutta</i>
Rainbow trout	<i>Salmo gairdnerii</i>
Carp	<i>Cyprinus carpio</i>
Sacramento blackfish	<i>Orthodon microlepidotus</i>
Hardhead	<i>Mylopharodon conocephalus</i>
Tui chub	<i>Siphateles bicolor</i>
Channel catfish	<i>Ictalurus punctatus</i>
White catfish	<i>Ictalurus catus</i>
Brown bullhead	<i>Ictalurus nebulosus</i>
Black bullhead	<i>Ictalurus melas</i>
Striped bass	<i>Roccus saxatilis</i>
Yellow perch	<i>Perca flavescens</i>
Largemouth bass	<i>Micropterus salmoides</i>
Pumpkinseed	<i>Lepomis gibbosus</i>
Black crappie	<i>Pomoxis nigromaculatus</i>

*Shellfish*

Giant Pacific oyster	<i>Crassostrea gigas</i>
Rock scallop	<i>Hinnites multirugosus</i>
Common Washington clam	<i>Saxidomus nuttalli</i>
Common littleneck clam	<i>Protothoca staminea</i>
Japanese littleneck clam	<i>Tapes semidecussata</i>
Bent-nose clam	<i>Macoma nasuto</i>
Gaper clam	<i>Schizothoerus nuttalli</i>

*Turtle*

Softshell turtle	<i>Trionyx spinifer</i>
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## SUMMARY REPORT OF THE 1963 MISSISSIPPI FISH KILL

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This paper will present a brief narrative of the principal findings and conclusions which led to the announcement that endrin was the cause of the 1963-64 fish kills on the lower Mississippi River. There is not time to give you the full technical detail that enabled us to define the source of the trouble. We will give you a summary of the results to date of studies intended to describe the sources, mechanism of transport, and modes of action of the pesticide contamination that exists in the lower Mississippi River. We hope to publish a complete account of these details at a future date.

The investigation was made as the result of a request for assistance from the executive secretary of the Louisiana Stream Control Commission directed to the then Division of Water Supply and Pollution Control, Public Health Service, U. S. Department of Health, Education, and Welfare, in November 1963. The Commission sought assistance in determining the cause of massive fish kills in the Louisiana

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portion of the Mississippi River. The ensuing investigation, begun in December of 1963, required the cooperation of many scientists. Because of the many collaborators who made important contributions, we will not attempt to describe their individual contributions.

In the latter part of 1964, the Lower Mississippi River Technical Assistance Project with main laboratories in Baton Rouge, Louisiana, was activated, and Mr. George J. Putnicki was appointed director. The objective of this project is a comprehensive study of the sources, types, mechanisms of transport, and biological effects of pesticides extant in the river.

#### PRE-INVESTIGATION HISTORY

Beginning in November of 1960, large numbers of dying fish were observed in the Mississippi and Atchafalaya Rivers and over hundreds of miles of associated bayous. Personnel of the Louisiana Stream Control Commission observed catfish, carp, freshwater drum, and threadfin shad dying. Approximately 95 percent of the fish were catfish, some of them 25 pounds and over. There were fewer mortalities in 1961 and 1962, but in the fall of 1963 a heavy kill again occurred. After the first year, buffalo and other freshwater species were also affected and; in addition, brackish-water fishes, such as menhaden, mullet, sea trout, and marine catfish, succumbed.

During the four years in which kills occurred, Louisiana personnel checked thoroughly the usual chemical characteristics of the river for possible clues. Temperature changes, dissolved oxygen, pH, and alkalinity were typical for the river, and they could detect no relationship between the mortality and the river stage nor were there abnormal changes in bottom fauna. Dying fish were examined by fish disease experts of the U. S. Fish and Wildlife Service in 1960 and 1963, but they found no significant number of pathogens.

#### ON-SITE INVESTIGATION BY PHS PERSONNEL

In December of 1963, the senior author and another biologist from the Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio, went to Baton Rouge to discuss the fish kill with Louisiana personnel and to investigate the field conditions. We saw dying fish in the river and canals in the Baton Rouge area and in the passes of the Mississippi River near the coastal town of Venice, Louisiana. Channel catfish, drum, buffalo, and shad were most affected, but we also observed acres of minnows at the surface that would convulse when stressed by our boat. In the brackish water area, mullet and menhaden were observed jumping several feet out of the water when disturbed by the wake of a boat; frequently we saw them land on

the levees or oil well platforms. Few of the affected fish were larger than two pounds, although one blue catfish, weighing 15 to 20 pounds, was observed upsidedown and dying in the Venice harbor. Louisiana personnel told us that more large fish were observed dying in 1960 than in 1963.

The symptomatology was similar in all of the dying fish, namely, convulsions, loss of equilibrium, some hemorrhagic areas on the body, and surface swimming. Only the channel catfish showed severe distension of the abdomen, which we found to be caused by gas and liquid contained in the alimentary tract. In all of the dying fish, the entire tract was devoid of food even in trace amounts; and yet there were excessive deposits of visceral fat and the length/weight ratios were excellent.

Approximately 100 pounds of dead or dying fish were frozen in dry ice; nine individual and composite blood samples from 31 dying fish were collected and analyzed; blood smears from 25 fish were made; internal organs of approximately 10 fish were preserved for histological examination; and stream bottom sediments from the kill area were collected and frozen. A number of dying fish of several species were placed individually in separate plastic bags and shipped to the U. S. Fish and Wildlife Service, Eastern Fish Disease Laboratory, Leetown, West Virginia, to be examined for pathogenic bacteria and fish parasites.

#### INITIAL LABORATORY STUDIES

The first phase of our laboratory work was to establish the general nature of the cause, *i.e.*, disease, parasite, toxic compound. Again, as in 1960, the U. S. Fish and Wildlife Service examinations were negative for disease and parasites. Studies in our PHS laboratories revealed no indication of botulism or toxins similar to paralytic shellfish poison. A survey of the concentrations of 19 metals in the gills of the dead fish showed nothing abnormal. Determinations of brain cholinesterase of the dead channel catfish eliminated organophosphate involvement. Small portions of tissues from the dying fish were fed to normal bullheads with no visible effect on the test fish. If a viral disease had caused the kill, we hoped in this manner to transmit it to the test fish.

Microscopic examination of tissues revealed abnormalities only in the kidney, where large vacuolated cells in the glomeruli were quite obvious. Studies of the blood smears showed low counts of both red and *white* cells, suggesting that disease was not the cause of the kill. During our on-site investigation, we determined the hematocrit

values to be 50 percent lower in the affected fish than in control fish of the same species also collected in Louisiana.

Tissues of dying fish fed to young mice indicated some toxicity, but these tests were inconclusive. When dissolved in water, chloroform extract residues of bottom sediments were toxic to bullheads and produced the symptoms exhibited by the dying river fish, including convulsions, loss of equilibrium, hemorrhaging, abdominal distension, and reduced hematocrits. Steam distillates of liver from the dying fish were toxic to the assay fish and produced symptoms similar to those resulting from the chloroform extracts of bottom sediments.

Several PHS laboratories examined extracts of tissue and found suspected pesticide peaks plus other unidentified ones. Four peaks were common to electron-capture gas chromatograms of extracts from all dying fish, chloroform extracts of bottom sediments, and assay fish exposed to the bottom sediment extracts. Occasionally, a fifth peak, thought to be dieldrin, was also present and only one peak, DDE (including DDT and DDD), was present in channel catfish from a Louisiana lake. Of the other three, one resembled endrin and two, which eluted early from the chromatograph, were unknown. For some time, these two (called X and Y) were thought to be peaks produced by the toxic substance because they were so prominent and the endrin peak so small in the chromatograms.

All attempts to identify X and Y, including infrared analyses, failed; finally, however, we devised a procedure whereby the material producing each gas chromatographic peak could be collected in nearly pure form and assayed using new-born guppies in 1 to 2 milliliters of water. These assays revealed that, from a given quantity of tissue, only the material for the peak thought to be endrin was toxic, and it produced in the guppies the well-known symptoms of endrin poisoning.

By this time five laboratories using two gas chromatographic detection systems agreed that the peak associated with the unknown toxicant matched exactly that of standard endrin; one laboratory observed double peaks for both endrin and the unknown toxic chemical. A double peak for endrin occurs frequently and is caused by a specific type of gas chromatograph column and column conditions. While chemists were continuing their search for more positive identification procedures for endrin, we assumed that endrin identification was sufficiently positive to continue the investigation. In the summer of 1964, the toxic peak was identified unequivocally as endrin by infrared analysis.

## LABORATORY TOXICITY EXPERIMENTS

The final phase of our "initial investigation" was to determine whether or not endrin killed the fish in the Mississippi River. We began measurement of the endrin in the nine blood samples from 31 fish and found endrin concentrations in the blood ranging from 0.12 to 0.56  $\mu\text{g/g}$ . Louisiana personnel sent us 20 additional blood samples representing approximately 64 catfish and buffalo collected from the river after the fish kill had ended. Nine of these blood samples were negative for endrin, and the rest were very much lower in endrin concentration than were the blood samples from dying fish of the same species collected from the river during the fish kill.

In our laboratory we established that for channel catfish, 0.3  $\mu\text{g/g}$  of endrin in the blood was always lethal and that as little as 0.23  $\mu\text{g/g}$  could cause death. A total of 53 catfish were exposed in this experiment. We also established that endrin is not stored in the blood of exposed fish. For three blood samples of dying channel catfish from the river, representing seven fish, the values were 0.40, 0.41, and 0.56  $\mu\text{g/g}$  endrin. Values for the living exposed fish (in the laboratory) were less than one-half or 0.2  $\mu\text{g/g}$ , except for a few individuals; the maximum value for a living exposed fish was 0.28  $\mu\text{g/g}$ .

Since the original investigation, we have determined the lethal threshold concentration of endrin in blood for bullheads, buffalo, and gizzard shad and have found that the five blood samples of these species collected from the dying specimens from the river were all well above the established lethal threshold.

In subsequent work, with the help of chemists from the Shell Chemical Company, the X and Y peaks were identified as being chemicals associated with endrin manufacture. These chemicals are from approximately 1,000 to 10,000 times less toxic to guppies than endrin. Other PHS laboratories measured water concentrations of endrin in the Mississippi River, employing the carbon adsorption procedure. At times they found endrin concentrations in water from 0.1 to 0.2  $\mu\text{g/l}$  at West Memphis and New Orleans. In our laboratory this concentration range has been shown to be acutely toxic to channel catfish, largemouth buffalo, and gizzard shad. We have also demonstrated that the presence of several different types and sizes of clay particles does not affect the toxicity of endrin in water.

## SUMMARY OF LABORATORY DATA

By way of brief summary, we were able to establish (1) the presence of endrin at toxic concentrations in the blood of dying river fish; (2) a sharp reduction in the blood concentration of endrin

in normal appearing fish of the same species collected from the river after the kill; (3) the presence of endrin in concentrations from 2 to 4  $\mu\text{g/g}$  in approximately 40 muscle samples from dying channel catfish; (4) the presence of lethal concentrations of endrin in Mississippi River water during certain periods; and (5) exact duplication, in the laboratory, of the endrin toxicity syndrome observed in the dying river fish including histological, hematological, and behavioral symptoms.

#### A BRIEF SUMMARY OF RECENT SURVEYS

The Lower Mississippi River Technical Assistance Project is currently gathering and evaluating data relative to the source, pattern, and extent of endrin pollution of the Lower Mississippi River from Hickman, Kentucky, to the Gulf of Mexico. In addition to the endrin manufacturer located in Memphis, the Velsicol Chemical Corporation, other known sources of endrin are pesticide formulators, the sugar cane grinding mills, and agricultural runoff. Endrin contributions to the Mississippi River from each of these sources is currently being evaluated by the Project.

Exceedingly high endrin concentrations were found in the sewers in the vicinity of the endrin manufacturer located in Memphis. One 3400-foot section of an 84-inch sewer in Memphis contained such high concentrations in accumulated sludges that this section was sealed and subsequently the sludge was removed. A vigorous program is underway to monitor the waters, sediments, and biota in the Mississippi and Atchafalaya Rivers, and major tributaries to the Mississippi between Hickman, Kentucky, and the Gulf of Mexico.

The Project reports that less endrin is now being discharged through the Wolf River Interceptor System from the Velsicol Plant than in the summer of 1964. This may be due in part to newly installed waste treatment facilities by the Velsicol Corporation, the by-passing of the 3400 linear foot section of Wolf River Interceptor sewer containing large deposits of endrin laden sludges, and discontinuance of the use of the Hollywood Dump for the disposal of solid and semi-solid wastes. The Project has also reported that no massive fish kills similar to the 1963 fish kill have occurred in the Lower Mississippi River in the winters of 1964 and 1965. During the 1965 calendar year, the water discharge in the Mississippi River ranged from approximately 200,000 to 1.2 million cfs. To produce an endrin concentration of 0.25  $\mu\text{g/l}$  in Mississippi River water during low flow conditions, a concentration clearly lethal to several species of fish, it is important to note that only 270 pounds of endrin per day would be required. Based on the most recent Project in-

vestigations, the Velsicol Chemical Corporation is now discharging less than six pounds per day.

Other Project studies show that endrin concentrations are substantially greater in bed materials than in adjacent waters. A careful evaluation of the role of suspended sediment in endrin transport is being conducted by the Project.

From the analyses of over 500 fish blood samples collected since October of 1964, with few exceptions, the concentrations of endrin in the blood of the apparently healthy fish have been below the established lethal threshold. Analyses of many water samples from the mainstem of the river have, with few exceptions, been well below the concentration required to cause fish mortality.

#### DISCUSSION

It is our conclusion that the evidence gathered during and since the 1963-64 Mississippi River fish kill clearly establishes endrin as being the cause of that mortality. In addition, no evidence has been presented to date to refute that conclusion.

Of course not everyone has agreed with our conclusion but of most concern are those who, seeking the truth, fail to comprehend the magnitude of endrin toxicity to fish and other aquatic animals. Perhaps it is difficult to understand that any substance in water in such minute concentrations as 0.1 ppb could be acutely toxic to fish. However, one must consider that in just two hours, the blood of a catfish can attain an endrin concentration of 1,000 or more times greater than that of the water in which the fish swims; understanding then comes more readily. In one of our studies we discovered that fathead minnows exposed to  $.015 \mu\text{g}/1$ , had total body concentrations 10,000 times greater than that of the water. Because of such concentrating ability, it is obvious that accurate toxicity data cannot be obtained when one or more pounds of bullheads are placed in a five- or ten-gallon aquarium in which the test water is *not* renewed continuously.

In view of the concentrating ability and the extreme toxicity mentioned above, one can readily realize the need to measure water concentrations of endrin in the parts per trillion range. Based on our work with clay particles suspended in water and the resulting effect on endrin toxicity, we cannot conclude that endrin will be less toxic just because the water is turbid.

Most of the endrin measurements made by other government agencies, both federal and state, have been in acceptable agreement with those reported by the PHS. This is an encouraging sign that we need only a better understanding of endrin toxicity to fish to reach

agreement as to the significance of the observed concentration in water, sediment, and biological samples.

Finally, Mr. Putnicki and I wish to emphasize that, although endrin has been proven as the cause of the 1963-64 Lower Mississippi River fish kill, we are fully aware of the need for pesticides in our present day economy and recognize that their use cannot be prohibited solely because they are hazardous to aquatic life. Materials less toxic to fish and better techniques of application must be used. Every possible step must be taken to prevent any recurrence of pesticide-caused fish kills such as those observed in the Lower Mississippi River in 1963-64.

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## FIXATION OF DDT IN ESTUARIES

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The history of fish and wildlife losses following applications of pesticides in the past 20 years has stressed the catastrophes that result from acute pollution. Growing evidence suggests, however, that the more subtle changes resulting from sublethal exposures actually may be more disastrous to the continued well-being of some of our wildlife resources.

An extensive literature reports the causal relationship between DDT and lowered viability of embryonic mollusks, fish, and birds. Continued field use of this pesticide has brought about the artificial selection of resistant strains of insects, amphibians, and fish. Usually, detailed laboratory and field studies have been necessary to identify the critical importance of chronic, sublethal levels of pollution as causes of these effects.

We may expect that future studies will identify even less obvious physiological changes in animal populations. Among them might be, for example, changed behavior in response to various environmental factors, such as temperature and salinity. Research on the effects of pesticides on breeding behavior, schooling, catchability, and resistance to stress must assume a high priority if we are to continue to protect and exploit efficiently our commercial fishery stocks.

In an attempt to assess the importance of pesticide pollution in the marine environment, the Bureau of Commercial Fisheries has undertaken a nationwide estuarine monitoring program to identify geographical and seasonal variations in residues of organochlorine



pesticides in estuaries with commercially important fisheries. The assumed transient nature of pesticide pollution in drainage basins and the technical difficulties in identifying trace amounts of chemical pollution in large water masses suggested the use of resident bioassay animals in the monitoring program.

Although controlled experiments at our laboratory had demonstrated the extraordinary ability of the eastern oyster (*Crassostrea virginica*) to retrieve and store organochlorine residues, we spent two years evaluating the suitability of other mollusks and fish. We also investigated the importance to the program of sampling frequency and the technology of preparing samples. The study area was the approximately 100 square miles of primary and secondary bays near Pensacola and Gulf Breeze, Florida, where our laboratory is located. These are typical estuarine waters, relatively free from industrial pollution, and important in that they serve as a nursery area for a wide variety of commercial fish and shellfish.

During these studies, we completed several diverse projects which will be reported in detail elsewhere. This paper summarizes certain findings that I consider important to an understanding of estuarine pollution by pesticides.

#### METHODOLOGY

Advances in the precision of analytical procedures enable us to detect, with confidence, organochlorine residues in biological samples in the range of 7 to 10 ppb. I am unaware of any evidence, however, that tissue residues of this magnitude constitute a health hazard to either vertebrate or invertebrate fauna. The existence of this level of pollution in estuarine waters is quite another matter. We find, under controlled laboratory conditions for example, that this amount of DDT in the water will inhibit 50 percent of the normal amount of shell deposition in oysters, and within 24 hours it will kill 50 to 100 percent of eight species of fish and crustacea that we have tested. We consider it necessary, therefore, to use the most sensitive analytical methods available to interpret the effect of sublethal contamination of the environment. The data reported here result from the use of gas chromatography with electron-capture analytical procedures.

The sensitivity of these procedures makes it imperative that we maintain the integrity of samples. The ubiquity of DDT in some environments makes it difficult to collect uncontaminated samples. Evidence is good, too, of the breakdown and loss of pesticide residues in biological samples that are improperly handled. It is customary to quick-freeze samples and keep them frozen until analysis

to prevent such changes. This procedure would impose economically unrealistic requirements in a monitoring program in which we contemplated the collection of about 3000 samples a year to be sent for analysis to us from 10 coastal states from Maine to Washington. Our tests of many of the standard tissue preservatives proved without exception that they failed to preserve intact the organochlorine pesticide residues.

After some searching, we discovered that the addition of anhydrous sodium sulfate to the sample did preserve the tissue without altering the pesticide content. In practice, sodium sulfate in the amount of 3 to 10 times the weight of the sample, depending on its moisture content, is homogenized with the tissue (plankton, oysters, fish) in an electric blender. A dry, free-flowing product results when the sample is alternately chilled and blended. The sample has the appearance of cornmeal; sealed in a screw-top jar, it may be stored at room temperature at least 30 days without deterioration. It may be shipped by surface mail to the analytical laboratory without recourse to freezing or other methods of preservation.

Since this processing is also the first step in the preparation of biological samples for chromatographic analysis, it accomplishes a double objective. We have been using this technique satisfactorily in the Bureau's monitoring program more than a year.

The selection of a sample size adequate to ensure statistical validity poses well-known problems. Obviously, the determination of pesticide residues in large fish and mammals is restricted to analyses of small portions of one or a few tissues in a small number of individuals. Oysters present no such physical problems and their metabolic activity is relatively uninfluenced by age, sex, or size. They remain physiologically active until water temperatures approach freezing, and they pump water through their bodies in excess of 20 hours a day. As a result, we find that analysis of only 12 individuals provides data representative of the population.

When the levels of DDT pollution are low, oysters concentrate it in their tissues at a uniform rate, and flush it from their bodies at a uniform rate when the pollution stops. Consequently, data on pesticide residues derived from oysters sampled periodically are indicative of both the quantity of pollution and the temporal changes.

It is very different with fish; pesticide residues are sequestered primarily in their adipose tissues, and only on starvation are they mobilized and lost. Typically, we find that in a given area young-of-the-year fish have only half as high DDT residues as are found in one-year-olds. Therefore, "monitor" samples must consist of fish of the same age groups to reflect accurately the degree of pollution.

Under laboratory conditions, the uptake of DDT directly from the water by the pinfish, *Lagodon rhomboides*, soon reaches a maximum. Further uptake is balanced by losses through normal metabolic processes. This maximum can be increased significantly, however, by incorporating DDT directly into the diet of the pinfish. Presumably this is why we find that 10 to 20 percent of the pinfish in contaminated wild populations may have DDT residues far in excess of the others in the sample. Correspondingly larger numbers of fish than oysters must be collected to reduce variability between replicate samples.

One of the surprising conclusions to be drawn from our monitoring data in the Pensacola Bay region concerns the concentration of pesticide residues in fauna in restricted areas. DDT residues in pinfish, oysters, and mussels (*Brachidontes recurvus*) regularly reflect the proximity of the collection site to human residential centers. This relation persists despite the fact that DDT is used periodically along many miles of uninhabited reaches of the shoreline. This localization of the residues in fauna geographically near the presumed source of contamination indicates that a large proportion of the DDT is biologically immobilized soon after its entrance into the ecosystem. The precise location of sampling stations may influence greatly our understanding of the area.

#### DDT RESIDUES IN FIELD SAMPLES

During 1964, we monitored a natural oyster reef at biweekly intervals to determine the level of pollution by organochlorine pesticides. Much of the time, DDT residues fluctuated between 10 and 20 ppb, a level we consider to be of negligible significance. Beginning in October and continuing through December, the concentration abruptly increased to about four times this value. The following year, we also monitored the plankton on which oysters feed in an attempt to determine the source of the DDT. A decisive increase of DDT residues in plankton that occurred in the summer was followed by a similar increase in residues in the oyster population in the fall.

This passage of DDT from the water to plankton to the oyster was a logical sequence of events, but it was only when we had the data on residues at hand and could estimate the time of the initial pollution of the water that we were able to identify the source of the DDT. We found that during July and August field crews carrying on an insect-control program sprayed the windrows of seaweed on the beaches with DDT to kill larvae of the dogfly, *Stomoxys calcitrans*, a noxious, biting pest. The amount of DDT used seemed

negligible; in fact, only once in the past two years had we observed a fish kill that appeared to result from this program. At that time, we found small fish and crustaceans dead and dying along a 200-yard stretch of shore and learned later that spray equipment had been washed in the area.

DDT residues in pinfish vary with both the age of the individuals and the source of the sample. Typically, values are below 0.5 ppm although they tend to increase with the age of the fish. Individual fish may have residues in the range of 12 to 14 ppm. Similar residue levels occur in several other species of resident fish routinely sampled in our local monitoring. Consequently, it was not surprising that, when one of our staff fortuitously collected a recently killed common loon, *Gavia immer*, analyses showed DDT residues of 129 ppm in the muscle and 179 ppm in the liver. Other workers have reported similar high concentrations of DDT and its metabolites in fish-eating birds.

We have scattered data that further illustrate the kinetics of DDT in the estuarine habitat. The mullet, *Mugil cephalus*, is a locally common, herbivorous fish that spawns in the late fall. Analyses of ovaries in that period indicate DDT residues in excess of 3 ppm. Recently we made residue analyses of an adult and of a juvenile specimen of the bottle-nose dolphin, *Tursiops truncatus*, which feeds extensively on mullet. Both specimens had residues of about 4 ppm of DDT and its metabolites in heart muscle and approximately 220 ppm in the blubber.

These findings might have been predicted with some confidence in view of the known persistence of DDT, its affinity for fatty tissue, and the relative position of the loon and dolphin in the food web.

#### DDT RESIDUES IN LABORATORY SAMPLES

What is the significance of these relatively high residues in apparently healthy animals? Laboratory observations on the effects of sublethal exposures to DDT enable us to analyze the entire test population under controlled conditions and so gain a better concept of the full impact of such pollution in the natural habitat.

In the dogfly-control program, slightly more than 130 pounds of pure DDT are used each year. Theoretically this amount, all applied at one time rather than over 2 months and evenly dispersed in the estuary, would give a concentration in excess of 1 ppb in the water. Since the DDT actually is applied along the beaches, heavy precipitation or a high tide could cause a localized concentration of DDT far in excess of this level.

The oyster, exposed to 1 ppb of DDT in flowing seawater in the

laboratory, may store 25 ppm or more in its tissues within 10 days. Simultaneously, it may immobilize in its fecal deposits an additional 8 to 10 percent of the entire amount of the DDT flowing through the system. The particulate DDT in these feces then becomes available to such detritus feeders as the polychaete worms which are important links in the invertebrate food chains.

Oysters exposed to 1 ppb of DDT exhibit little obvious damage, but their growth may be reduced by 20 percent or more during the exposure period. This loss would not be observed in the natural habitat however. During the reproductive season, much of the DDT residue is located in the ovary where its effect on productivity is not known.

When DDT-contaminated oyster meats were incorporated in the diet of croakers, *Micropogon undulatus*, at a rate that the total DDT residue approximated 2 ppm, 50 percent of the fish died within 43 days. When we fed the same diet to brown shrimp, *Penaeus aztecus*, 50 percent died within two weeks. Although losses of this kind are easily documented in the laboratory, they would be almost impossible to detect in nature. Analyses of animals killed by this diet uniformly showed DDT residues lower than those frequently observed in apparently healthy specimens.

Curiously, when we permitted the oyster drill, *Thais haemastoma*, to feed on live oysters having DDT residues of about 50 ppm, the snails suffered no apparent ill-effects and built up DDT residues of less than 4 ppm in their bodies.

#### CONCLUSIONS

Plankton plays an important role in the introduction of pesticide contamination into the estuarine food web. Filter-feeding animals further concentrate these residues and immobilize significant amounts of DDT in benthic deposits where it becomes available to detritus feeders.

DDT residues may be fatal to predators at different trophic levels depending on the amount ingested at one time. It is probable that higher death rates and significant losses in productivity exist undetected in estuarine fauna contaminated with DDT.

#### ACKNOWLEDGMENT

I thank the entire staff of our laboratory whose efforts have made this summary possible.

## BALD EAGLE PESTICIDE RELATIONS

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Bald eagles have become scarce in many parts of the United States, and their reproductive success exceedingly low. They produced young in only 3 of 16 nests studied in 1964 in the mid-Atlantic States, and, on a nationwide basis, the percentage of young appears to be gradually declining (Sprunt and Ligas, 1963). Concern for conservation of the bald eagle led to the initiation in 1961 of a series of cooperative studies.

In this year, the National Audubon Society undertook a nationwide survey of numbers, distribution, and nesting success. At the same time, the Bureau of Sport Fisheries and Wildlife began investigations of the effects of environmental pollution on eagles.

The Bureau's first studies were focused on DDT. Experimental investigations of DDT toxicity to eagles and the metabolism of DDT by eagles were made in Alaska in the winters of 1961-62 and 1962-63. Residue analyses of eagles and eagle eggs were undertaken on a continuing basis. Beginning with eagles received early in 1964, analyses were expanded to include other chlorinated hydrocarbons. I will summarize the results and conclusions from those studies and briefly describe our current program and plans. Progress reports concerning portions of this work have been presented by DeWitt and Buckley (1962) and Buckley and DeWitt (1963).

### DDT TOXICITY STUDIES

The DDT toxicity studies were made to determine the dietary dosage of DDT that would kill eagles and hence to learn whether or not eagles were unusually susceptible to DDT poisoning. A second objective was to determine the quantities of residue present in the tissues of eagles killed by DDT, as an aid in understanding the importance of the quantities in eagles from the field.

Care, food consumption, and behavior have been described by Chura and Stewart (unpublished manuscript). Spermatogenesis in dosed birds has been discussed by Locke, Chura, and Stewart (unpublished manuscript). Hence these aspects need not be considered here.

The first experimental studies were performed with 11 eagles caught near the Chilkat River near Haines, Alaska, and kept at the Petersburg Experimental Fur Station. Dietary dosages were 5, 83,

414, and 2070 parts per million (ppm) computed on the basis of dry weight of the food, which consisted of ground salmon heads and other waste fish products. Toxicant added on a wet-weight basis was at the rates of 3, 48, 240, and 1200 ppm. The DDT (technicalgrade, p,p' isomer) was dissolved in vegetable oil and mixed thoroughly with the fish.

Two birds were fed clean food for the full 112 days of the study; two birds were fed at each of the three lowest dosages; and three birds were fed at the highest dosage.

Dosage was not continuously the same, for food consumption varied from day to day. The eagles on the highest dosage ate less from the start, and all eagles that died ate less as time passed.

During the first week of dosage, birds fed 5 ppm of DDT in their food consumed 0.3 mg DDT per kg of body weight per day (on the basis of their weights at capture). Those fed 83 ppm consumed 3 mg/kg/day; and those fed 414 ppm consumed 15-18 mg/kg/day. Two eagles fed 2070 ppm of DDT consumed 55-70 mg/kg/day, but the third consumed only 28 mg/kg/day during the first two weeks, less the first week (Table 1).

All eagles fed more than 400 ppm (dry weight) died in 2 months or less. Of the two fed about 80 ppm, one died in 71 days with pronounced tremors. The other survived 112 days but showed some

TABLE 1. TOXICITY OF DDT TO BALD EAGLES

Bird Number	Sex and Age	DDT Dosage			Days on Test	Died or Killed
		DDT Added to Diet <sup>1</sup> (ppm dry weight)	mg/kg Per Day <sup>2</sup>	mg Per Day <sup>2</sup>		
1	♂ adult	0	0	0	112	K
10	immature	0	0	0	112	K
3	immature	5	0.3	1.4	98	escaped
6	♂ adult	5	0.3	1.2	77	D
2	♂ adult	83	2.8	15.8	71	D
9	♂ adult	83	3.2	16.9	112	K
5	♂ immature	414	17.7	76.1	62	D
7	♀ immature	414	15.4	87.0	59	D
4	♂ adult	2070	70.0	334.6	23	D
8	♂ immature-adult	2070	55.0	269.6	18	D
4A	♂ adult	2070	27.6	140.3	15	D

<sup>1</sup> Technicalgrade p,p' DDT was dissolved in vegetable oil and mixed with the diet of ground salmon heads and other fish. Dietary content of DDT expressed as parts per million of DDT in the wet weight of the food was approximately 3, 48, 240, and 1200. Computations to express DDT intake in terms of dry weight were made on the basis of an average moisture content of 42 percent, as determined in samples of the prepared food. Nominal dry weight doses reported by Buckley and DeWitt (1963) were preliminary computations based on an estimated 70 percent moisture content, the amount present in fresh fish fillets.

<sup>2</sup> Calculation of milligrams of DDT per kilogram of body weight per day is based on capture weights of birds. Daily intake of DDT is computed for the early dosage period before decline in food consumption by birds that died later. This period was March 9-15, 1962, for all birds except one. Bird 4A was started on dosage May 11 and ate little the first week; hence computations are for May 11-May 24, 1962.

tremors and erratic wing jerking suggestive of a toxic effect. Thus a dosage that would kill half the birds during a 3-4 month period may be near 80 ppm, possibly somewhat lower.

Mortality at this dosage level does not indicate any unusual susceptibility of eagles to death from DDT. In studies with other species at Patuxent, where DDT is similarly dissolved in oil and mixed with the diet, it has become evident that long-term tolerance limits for at least part of an experimental group are near 40 ppm for mallard ducks and 25 ppm for bobwhite and coturnix quail.

The one eagle that died on the 5 ppm dosage was believed to have succumbed from causes other than DDT. The other eagle on this dosage remained apparently well for 98 days, when it escaped. In studies the next year, 15 eagles were fed DDT in their diet at the rate of approximately 5 ppm. One died within 39 days, probably from causes unrelated to dosage. Four survived 120 days of dosage and 10, 60 days of dosage with no obvious ill effects.

Residue analyses were made by the colorimetric methods described by Schechter *et al.* (1945). Readings were made at wavelengths 596 and hence are primarily for DDT and DDD.

In the eagles fed the two highest dosages, where the cause of death almost certainly was DDT poisoning, the quantities of DDT and DDD in the brain ranged from 58 to 86 ppm (wet weight) (58, 63, 80, 85, and 86 ppm) (Table 2). These amounts were very similar to those associated with DDT-induced death in several other species of both birds and mammals, where average residues were 43-100 ppm, and a hazard zone could be considered to begin in the vicinity of 30 ppm (Stickel *et al.*, 1966).

The conclusion from the eagle toxicity tests is that there is little reason to suspect any unusual susceptibility of eagles to DDT mortality. The possibility of more obscure effects on physiology or behavior will require other studies.

#### DDT KINETICS

The second series of experimental studies, conducted in Alaska in the winter of 1962-63, was made to measure the storage and loss

TABLE 2. DDT RESIDUES<sup>1</sup> IN BALD EAGLES KILLED BY DDT

Bird Number	Sex and Age	Dosage (ppm dry weight)	Brain	Liver	Muscle
5	♂ immature	414	63	280	73
7	♀ immature	414	80	—	291
4	♂ adult	2070	58	715	112
8	♂ immature	2070	86	391	169
4A	♂ adult	2070	85	—	149

<sup>1</sup> Colorimetrically determined by the method described by Schechter *et al.*, 1945. Read at wavelength 596, hence primarily DDT + DDD.



of DDT by eagles when the dietary intake was comparable to what might be available in the field. This information was sought as an aid in judging the likelihood that intake of small quantities of DDT over a long period of time would build up to lethal levels. A dosage of approximately 5 ppm dry weight was used; wet-weight equivalent was 3 ppm. Fish in some areas may contain much higher residues than these, and much lower in other areas. Residues in birds, sometimes eaten by eagles, also are variable.

The experimental design called for dosage of one group of birds for 60 days, one group for 120 days, and one group for 60 days followed by clean food for 60 days. Six eagles were in the 60-day group, four in each of the other two groups. Analyses were made for DDT and the metabolites DDD and DDE in various tissues and organs. Readings were made by gas chromatography following extraction in Soxhlet with petroleum ether and Skellysolve B, partitioning with acetonitrile, and passage through a florisol column.

In these experimental eagles, the amount of DDT + DDD in the tissues increased between 60 and 120 days on dosage and decreased after dosage was discontinued. A similar pattern of gain and loss followed in brain, liver, breast muscle, fat, and in the composited remainders (Figure 1). Rates were 0.4 to 0.8 per cent per day, computed as  $\log_e(\text{content at time 2}/\text{content at time 1})/\text{days}$ . These rates were used to approximate the time at which half the toxicant would be gone, the time at which a steady state or equilibrium would be reached, and the residue level that would be reached at the time of equilibrium. Estimates were made as described by Nelson (1961) and by Doluisio and Swintosky (1965).

These procedures assume that the rates of loss remain constant with time. There is evidence, however, that this may not be strictly true, and that rates may decline as residue content of tissue declines (Bovard *et al.* 1961). Hence, the estimates of half-life derived here for DDT residues in eagle tissues may be somewhat short. Rates were estimated from the parts per million of chemical in the lipid (fat) portion of the tissues.

It was estimated that about half the residues of DDT + DDD would be gone in 3-5 months, and hence that a balance between intake and loss probably would require  $1\frac{1}{2}$  to  $2\frac{1}{2}$  years if this same dosage continued.

Brain residues of DDT + DDD reached 0.28 ppm (wet weight) after 120 days on dosage. The estimated level at equilibrium was less than 1 ppm, far below the 58-86 ppm found in eagles killed by DDT. Liver residues of DDT + DDD were 0.68 ppm after 120 days on

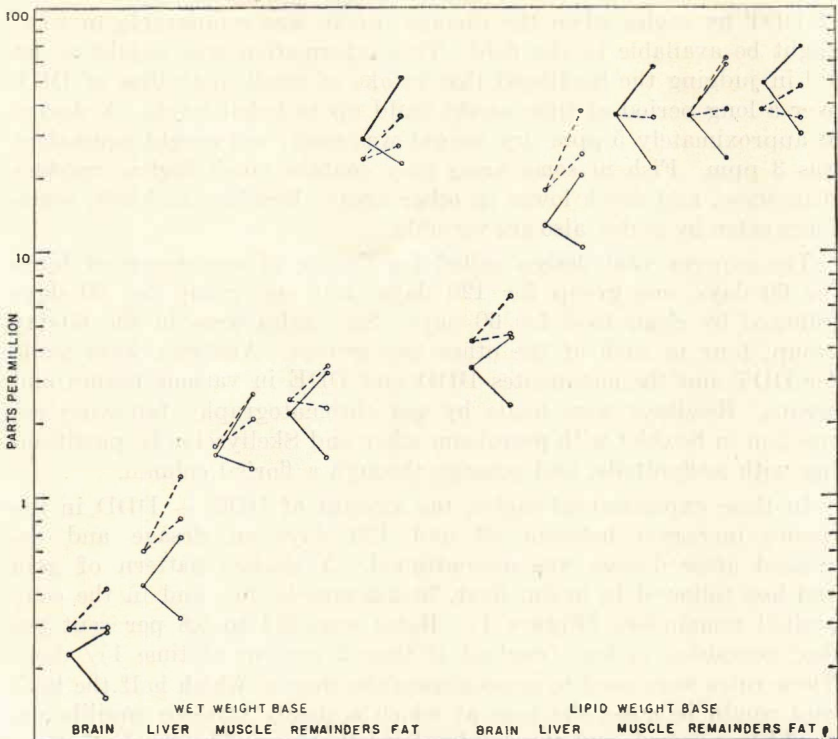


Figure 1. Accumulation and loss of DDT residues in tissues of bald eagles experimentally fed DDT. Residues after 60 days on a diet containing 5 ppm p,p' DDT are shown at the left apex (averages for 6 birds). Residues after 120 days on this same dosage are shown by the upper arm; residues after 60 days on dosage plus 60 days on clean food are shown by the lower arm (averages for 4 birds each). DDT plus DDD is indicated as a solid line, DDE as a broken line. Coefficients of variation for the wet weight values were: 20-29 percent for brain, liver, fat, and remainders and 40 percent for muscle. For the lipid weight values, coefficients of variation were 25-29 percent for brain, liver, and remainders and 36 percent for muscle and fat.

dosage. The level at equilibrium was estimated at 2 ppm, also far below the amounts in eagles killed by DDT.

Residues of DDE, a less toxic metabolite of DDT, also increased in tissues between 60 days and 120 days of dosage. Clean food for 60 days, however, did not result in a diminution of DDE in the tissues, and quantities in the liver in fact increased. It is not unreasonable that DDT would continue to be transformed by the liver after dietary intake stopped, for a considerable supply of unchanged DDT still was present in the various tissues. A portion of the loss of DDT from the tissues after dosage can be accounted for by transformation to DDE. DDE itself presumably would be lost in time and there is no reason to expect that it would have reached toxic levels in the experimental eagles. Quantities of DDE measured

at 120 days were 0.42 ppm in brain, 1.22 ppm in liver, 2.58 ppm in muscle, 3.38 ppm in remainders, and 35.68 ppm in fat.

The importance of tissue residues of DDE is not understood. DDE did not appear to be critical in deaths of a group of experimental cowbirds we studied, nor in certain field studies. However, DDE in large amounts will kill birds and its residues could well be important at some presently unknown quantity. DDE is not used as an insecticide, but is produced from DDT by many living organisms. DDE in eagle tissues thus may have been obtained as DDE from the fish the birds ate, or it may have been produced by the birds themselves from DDT consumed, making the interpretation of its presence especially difficult.

Gradual loss of DDT from tissues of animals after dosage is discontinued has been shown in many other studies. For example, Laug *et al.* (1950) and Ortega *et al.* (1956) described loss of DDT in laboratory rats; Bovard *et al.* (1961) in cattle, and Durham *et al.* (1963) in rhesus monkeys. Noakes and Benfield (1965) reported loss of DDT and DDD in chickens and also noted a post-dosage increase of DDE, as was observed in the eagles.

The conclusions from this portion of the study are that continuous intake of DDT by bald eagles in quantities as high as 5 ppm in the diet is unlikely to produce lethal amounts in the tissues. DDT content of the tissues will increase slowly for many months before a metabolic balance is reached, and will be lost slowly when intake of DDT is discontinued. The pattern and rates are similar to those in other animals, indicating similar basic processes.

#### ANALYSES OF EAGLES FROM THE FIELD

Pesticide residues in the tissues of eagles from the field provide a measure of environmental exposure. They can be useful in assessing hazard if experimental studies have provided the basis for interpretation. Such interpretive studies have been few, confined largely to DDT, and focused on the determination of lethal quantities. However, enough information is available concerning dieldrin to permit at least tentative judgments.

In the summer of 1965, we began broad spectrum analyses of eagles from the field. Readings were made by gas- and thin-layer chromatography after extraction with petroleum ether in Soxhlet apparatus, partitioning with acetonitrile, and elution through a florasil column. Sixteen bald eagles have been completed. DDT, DDD, DDE, and dieldrin have been found in all of them and traces of heptachlor epoxide have been found in many. Brain samples were available for 14. Quantities of DDT + DDD were 1 ppm or lower in 13

specimens, a magnitude similar to that of eagles in the experimental studies, where dietary dosage was 5 ppm. One specimen contained 7 ppm. Quantities of dieldrin were 1 ppm or lower in 12 specimens, 2 ppm in 1 specimen, and 8 ppm in 1 specimen.

The eagle with 7 ppm DDT + DDD in the brain also contained 8 ppm dieldrin. Quantities of DDT + DDD above 30 ppm in the brain can be considered in a zone of serious concern, as discussed above, but this amount is considerably above 7 ppm. However, 8 ppm of dieldrin probably is more critical, as indicated by residues in animals found dead in the field and in those killed in laboratory studies. Brain residues in 23 animals found dead after field applications of dieldrin ranged from 2 to 20 ppm, with only one below 6 ppm. These animals included meadowlarks, cottontail rabbits, and cottonrats (Patuxent Center, unpublished data); green-winged teal, red-head duck, lesser scaup, and shoveller (Sheldon *et al.*, 1963) with no evidence to suggest species differences. Six domestic animals (cattle, sheep, and dogs) dosed experimentally contained 10-30 ppm of dieldrin in their brains (Kitselman *et al.*, 1950). Two experimentally dosed pheasants died containing 10 and 18 ppm of dieldrin in their brains (McEwen *et al.*, 1963) and six dogs that died or were killed *in extremis* contained 2 to 9 ppm (average, 6 ppm) (Harrison *et al.*, 1963). Thus, 8 ppm must be considered in the zone of hazard.

This particular eagle was an immature female, found dead at the base of a known roosting tree near Vernon, Vermont, on May 1, 1964. Autopsy by L. N. Locke showed the bird to be very thin, but without diagnostic lesions.

Earlier analyses of field eagles made at our laboratory by colorimetric methods of Schechter *et al.* (1945) and read at wavelength 540 showed residues of DDE overshadowing whatever DDT + DDD may have been present. These DDE residues were between 0 and 8 ppm in the brains of 22 eagles, about 17 ppm in 1, and between 31 and 35 ppm in 5. With DDT and DDD present in smaller, although unknown, amounts, it is apparent that in this group also the amounts were below the lethally critical zone in most. The significance of the five readings above 30 ppm cannot be properly evaluated.

DDE residues in brains of the eagles read for the spectrum of pesticides were less than 2 ppm in 10 specimens, 6 to 33 ppm in 4 specimens. The 33 ppm occurred in the same eagle that had high readings of DDT + DDD and dieldrin. Quantities of DDE in the brain ordinarily were higher than those of DDT + DDD but occasionally approached equality.

Liver residues also will be given here for the record. In the

broad spectrum analyses, the livers of 16 birds contained traces to 42 ppm of DDE with a median value of 2 ppm. Twelve contained less than 10 ppm. DDT + DDD measured from traces to 8 ppm, with a median of 1 ppm. Dieldrin measured 1 or <1 ppm in 14 specimens, 2 ppm in 1 specimen, and 5 ppm in one specimen. The DDE residues determined earlier by colorimetric methods in 64 specimens ranged from none detected to 305 ppm, with a median value of 6 ppm. The higher median value in the colorimetric series may have been primarily the result of methodological differences, for comparisons have shown that colorimetric readings made at the DDE wavelength generally are somewhat higher than DDE readings by gas and thin layer chromatography.

Measurement of the quantity of pesticides stored in the body is useful as an indicator of environmental contamination, and of the reserve supply that may become critical when food supply is reduced or weight is lost for other reasons. For this purpose, we have analyzed the carcass remainders, which include the entire body after the gastrointestinal tract, brain, and liver have been removed. The quantities of DDE in 16 specimens ranged from traces to more than 50 ppm with a median of 9 ppm. Trace quantities of heptachlor epoxide were present in about half the specimens. The most nearly comparable readings from the earlier colorimetric analyses are those for muscle. In these, DDE ranged from 0 to 118 ppm in 61 specimens with a median of 5 ppm.

Nine bald eagle eggs have been analyzed for pesticide residues (Table 3). Residue readings were adjusted to permit comparisons, for different amounts of drying in over-age eggs are a source of great

TABLE 3. PESTICIDES IN EGGS OF BALD EAGLES

Date	Location	Parts Per Million (as weighed at analysis)				Parts Per Million (adjusted) <sup>1</sup>			
		DDE	DDD	DDT	Dieldrin	DDE	DDD	DDT	Dieldrin
1962	New Jersey <sup>2</sup>	36.9	—	—	—	25-32	—	—	—
1962	New Jersey <sup>2</sup>	11.4	—	—	—	4-6	—	—	—
1962	New Jersey <sup>2</sup>	24.3	—	—	—	11-14	—	—	—
1963	Missouri <sup>2</sup>	5.6	—	—	—	4-6	—	—	—
1963	Missouri <sup>2</sup>	1.1	—	—	—	1	—	—	—
1964	Maine	14.9	2.5	0.2	2.5	4.6	0.8	0.1	0.8
1964	New Jersey	8.6	8.6	0.3	1.7	4.6	4.6	0.2	0.9
1964	New Jersey	7.6	6.1	0.3	1.5	5.0	4.0	0.2	1.0
1965	Florida <sup>3</sup>	21.5	4.3	0.9	0.9	13.0	2.6	0.5	0.5

<sup>1</sup> Adjustment procedure is described in the text.<sup>2</sup> Colorimetric readings, primarily DDE.<sup>3</sup> Also a trace of heptachlor epoxide.

distortion if weights are taken at face value. The adjustments were made on the basis of egg volume as described by Stickel *et al.* (1965). The specific gravity was taken as 1 mg per ml, since the actual specific gravity of fresh eagle eggs is not accurately known. Adjusted residue readings (primarily DDE) in five eggs analyzed colorimetrically ranged from 1 to about 30 ppm. Four read for a broader spectrum of compounds contained 5 to 13 ppm of DDE, 1 to 5 ppm of DDT + DDE and 0.5 to 1 ppm of dieldrin.

Transmission of pesticide residues from parent to offspring via the eggs of birds is well known. The quantity of these residues that may indicate an adverse effect on hatching and survival is far from clear, however. Genelly and Rudd (1956) have reported that pheasant eggs containing 162 and 349 parts per million hatched as well as the controls, but that early survival was reduced. Keith (1965) reported 202 ppm DDE, 19 ppm DDT, and 6 ppm DDD in live gull eggs. Quantities in eagle eggs so far reported are so much lower than these that they provide little basis for suspecting that DDT in the eggs prevented hatching. Interpretation of the effects of dieldrin or of dieldrin plus the DDT-related compounds cannot presently be made.

The conclusions to be drawn from the results of field analyses are, first, that exposure of eagles to DDT and dieldrin is nationwide, as it is for most other animals, including people; second, that at least an occasional eagle obtains enough dieldrin and possibly enough DDT to place him in hazard; and third, that most eagles that die in the United States today die of causes other than pesticide poisoning. The important question of sublethal effects on behavior, particularly parental behavior, cannot yet be answered.

#### RESEARCH PLANS

Our plans for further work with eagles include a continuous monitoring of eggs and adults for pesticide residues. We hope to extend these analyses to include some of the more important heavy metals that are present as environmental pollutants, for we view the eagle problem as a part of the larger problem of environmental pollution that affects many species and many environments. Food chain investigations specific to eagles will be undertaken jointly with the National Audubon Society, as part of our research in ecological systems.

We believe the need for better understanding of the meaning of residues in eggs and tissues remains critical, and will require additional experimentation with various species. It has seemed important to make tests with a predatory species, even if it could not be the

eagle. Hence we have established a colony of sparrow hawks to test reproductive effects. Thirty-six pairs are now on experiment with dosages of DDT and dieldrin.

## ACKNOWLEDGMENTS

Work with eagles at Patuxent has entailed extensive participation by many members of the staff, past and present. W. H. Stickel directed the Alaskan studies, which were planned jointly with D. W. Hayne, L. F. Stickel, and J. L. Buckley and conducted by N. J. Chura and P. A. Stewart. Mary Myers assisted with data analysis and record keeping for much of the study. L. N. Locke performed autopsy examinations and dissections of the field-collected specimens, assisted by J. D. Frye, who also participated in parts of the analytical work. Colorimetric analyses were performed under the direction of J. B. DeWitt, by V. Adomaitis and G. E. Bagley, in addition to the three junior authors, who also have performed the subsequent analyses of field specimens. Analyses of experimental eagles from the 1962-63 study were performed by the Wisconsin Alumni Research Foundation, under the direction of F. B. Coon. J. R. Leekley, director of the Petersburg Fur Station, made available many facilities necessary to the Alaskan portion of the study. Cooperators throughout the United States have submitted eagles for analysis.

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#### PANEL DISCUSSION

DISCUSSION LEADER DUSTMAN: Ladies and gentlemen, you have just heard four high-quality papers by members of the pesticide panel. I am sure that there are many of you in the audience who would wish to ask questions of the panel members or make comments relating directly to the papers that have been given. You are invited to do so at this time.

DR. F. J. CLAFFEY [New York]: My question is directed to Dr. Butler. I am very much interested in plankton and am making a study now on DDT-plankton relationships. I was wondering if, in your term "plankton," you refer to net plankton, what we call phytoplankton, or the zooplanktons.

DR. BUTLER: This is net plankton.

DISCUSSION LEADER DUSTMAN: Who will be the next, please?

DR. A. STARKER LEOPOLD [University of California]: I have a question for Dr. Mount. Did I understand you to say that turbidity had no effect on the toxicity of endrin, either plus or minus?

DR. MOUNT: Our laboratory has looked into this matter to some extent, and I know of no other lab which has done so. In our experiments we used a purified clay, sorted into known particle sizes of from one to two microns. We also used a clay loam which contained about 10 to 12 percent of organic matter sorted into two micron or less particle sizes.

This was introduced into the water before endrin, and we could detect no significant absorption, surely less than 5 or 10 percent by this clay in the three of four hours it was in the test chambers. It did not affect statistically the toxicity of endrin to the fish that were exposed.

This was acute toxicity based on mortality and 4-day exposures.

Dr. Ferguson of Mississippi State University has also looked into this matter. Some of his work has been published, and in that he stated that, when he took silt or bottom sediments from bayous which were receiving runoff from agricultural lands, the samples contained concentrations of endrin in the 50 to 100 parts per billion range. If he took these sediments, put them in a container, added water, stirred it and let it settle, and then put in fish, he got no toxicity. So it would appear that there might be a difference as to when the soil and the endrin come into contact.

I am not proposing that this is true for all clays. I am not proposing it is true for all pesticides, but I do think it is erroneous to assume, because one pesticide is highly absorbed by silt, that all will be highly absorbed.

DR. LEOPOLD: This question is of particular interest to us right now in the San Francisco Bay area because current studies indicate that the concentrations



of DDT in anchovies inside the Bay are considerably less than in the same species in the open ocean. This is DDT, admittedly a different chemical, and yet the only possible explanation that we can see at the moment is that somehow the turbidity of the Bay may get this material out of the normal matter consumed by the anchovy.

DR. MOUNT: It is our experience with DDT, and admittedly it is very limited, that it is much more absorptive on the clay particles and small suspended material than is endrin. For example, we cannot pipe out a sample of water containing DDT and get reproducible results from it. We can do that with the endrin, and we can do it with dieldrin, indicating to me, at least, that DDT is absorbed onto the glassware, whereas the other two are not.

I might also mention, while you raised the point, that we did do a static test in which we were renewing the solutions with Mississippi River water, and endrin was equally toxic in Mississippi River water as it was with perfectly clear water.

DR. ARCHIBALD COWAN [University of Michigan]: I would like to ask Dr. Butler if he gave the concentration that occurred in the water in the estuary.

DR. BUTLER: Because of the difficulty of water analyses from our point of view, we have taken no water samples at all. The oyster is far more efficient than we are in detecting small amounts, and we use this as a basis of our testing.

DR. COWAN: The second question: Have you done any analysis by bottom dredging?

DR. BUTLER: No, sir, we have not.

CHAIRMAN HICKEY: I would like to try Dr. Leopold's question. If the material is attached to soil particles, it is not yet in the biological system. Mud in the bottom of Lake Michigan near Dor County, Wisconsin, was running 0.014 parts per million of DDT, but in the *Pontoporeia* which lived in the mud, the concentration was 0.4. What I am impressed with in our work in the Middle West is that this larger body of water, Lake Michigan, is far more contaminated than the smaller lakes we are sampling in our own state and in neighboring states. The explanation as to why we have a large body of water so contaminated is not yet forthcoming.

This may be comparable to what you are encountering in California between the Bay and the ocean.

MR. KEITH: I think we are running into danger here by trying to make it too simple. There are many things that can be in water, not just clay or organics, but specific entities. Water quality is a very diverse thing, and what may be involved with adhesion or adherence in one case may not be in another.

There were some endrin fish kills in the Central Valley of California, and Ben Glading's men and Dan, who was one of the water quality specialists, worked some experiments. This was in glass bottles and didn't amount to much, but they did come out with some interesting findings. As I recall, when they allowed the water to settle and put the fish in, it didn't kill them, but when they shook the bottle so that the water was turbulent when they put the fish in, the fish died.

But I think again it is dangerous to try to simplify this too much. We are talking about a number of different constituents, not all of which are even dead. We take live material in water that has pesticides involved.

So when you filter water and run an analysis on the two phases, you may get entirely different results in different cases.

Also, the Tule Lake refuge in northern California may have a bearing on this. We sampled water that entered the refuge in and out of the flow irrigation canals and filtered this water. The residue in the suspended material captured on filter paper was up about 25 ppm on the average, edging on up to about 90 ppm in streams.

We also took water samples from the middle of the refuge out in the marsh habitat. This water originated from the same source as that in the earlier sample but had been in the refuge longer. The residues dropped to about 6 ppm in the material we filtered from water. In no case did we identify what we were measuring.

Finally, we put gallon jars in the bottom of the marsh and collected, tried it, and eventually sifted sediment from the water into the jars. These materials had very low residues, often below 1 ppm. So if, indeed, it was the same strip substrate that we were sampling all the way through on the filter paper, something had acted upon the pesticide between the time it entered the refuge and when the material was finally deposited in the gallon jars.

Some work still unpublished on *Daphnea* comes to bear here, where concentrations in water are tremendously degraded in a very short time, merely by the presence of *Daphnia*. *Daphnia* accumulates some of this, but there it is a total loss of the parent material through the degradation of the *Daphnia*.

DISCUSSION LEADER DUSTMAN: Thank you, Mr. Keith. The chair recognizes Dr. Mount.

DR. MOUNT: I just wanted to say that I agree with what you said exactly, and again, so there will not be any confusion, I did not want to say that it necessarily would not be more toxic if suspended material were present. I simply said that because it is present, you can't automatically assume that it is going to be less toxic.

For example, we know that fish have a fantastic ability to remove endrin from the water and many other pesticides, too, when they are in exceedingly low concentrations in water. This tells me that they have the ability to absorb it quite well, and it is obvious, at least to me, why the fish would not be able to take it off the silt particles as it passes over their gills. I want also to emphasize that most of these examples that you gave were cases where the pesticide probably was applied to the soil. That is an agricultural activity, whereas I wanted to make it plain again that we were adding the endrin after the soil was in the water. I am convinced there must be some effect involved at this point, too.

We were after, obviously, an industrial situation here more than we were the total ecological data.

DR. CLAFFEY [New York]: There is a question I would like to ask Dr. Butler to comment on. I was wondering how he feels that more studies should be made not only on the effects of DDT but other pesticides on plankton. Does he feel more studies are needed on the effects on plankton?

DR. BUTLER: In the marine habitat plankton occupies a much more important position in the trophic web than it does in the fresh-water habitat, and for this reason we have undertaken a program to find out the effects of all of the commonly used pesticides on plankton.

Initially we were working with wild plankton communities which contained a large amount of organic and inorganic debris and an unknown percentage of zooplankton versus phytoplankton.

At the present time we have refined our studies to the extent that we are working with unialgal cultures of perhaps five of the marine phytoplanktons that are most useful as food for mollusk larvae.

These have been isolated by other laboratories and are well known. We are evaluating the effects of graded concentrations of pure pesticides of all the known categories that we have today on their effects as they interfere with cell division in these unialgal cultures over a period of 96 hours.

At the present time, we have processed data on perhaps 40 of the common pesticides for this type of study.

MR. DAVID DICKEY [Western Illinois University]: I would like to ask Dr. Stickel if she feels the work that was published in the 1964 report of pesticide investigations concerning osprey can be compared to that of the bald eagle? That work implied that a high concentration of pesticides in the eggs was directly related to the decrease in production.

DR. LUCILLE F. STICKEL: I don't believe that that was the implication. At least, it was not the implication that was intended. There was a very slight difference in the DDT concentration in the eggs we analyzed from the ospreys in Connecticut and in those from the Potomac—I believe 6 ppm as opposed to 3 ppm. Both of these levels are very low by comparison with anything that is

effective either in the field or in controlled studies in the laboratory. My conclusion is merely that the Connecticut River has more DDT in it than the Potomac. Just because there is this correlation, you can't transfer it to the effect on reproduction, at least with the knowledge that we have at present.

DR. GUSTAV A. SWANSON [New York]: I would like to ask Dr. Stickel, and possibly the other speakers, if they feel that it is possible that where animals in the field are under quite a different kind of stress, the same level of concentration of pesticide might not be more hazardous than it is under experimental conditions where the subjects are kept in pens or aquaria and given all the food they need.

DR. STICKEL: There has been shown to be a relationship between their susceptibility to pesticides and many other things, including dietary protein. Obviously there are differences. I don't believe that there would be a difference in the residue levels in the tissues in organs at death. The phenomena that you speak of in the field have been reproduced in the laboratory to some degree. Animals under stress, with several different kinds of stress, disturbance, and, in particular the stress of weight loss, do succumb more readily than those not under the stress. Even laboratory rats that are kept isolated and quiet will not succumb at the same levels as those that are disturbed. So the full results in a complex field situation, of course, cannot be predicted. But I don't believe any gross misunderstanding is apt to result, because there have been enough experimental studies where the stress factor has been considered closely.

DR. MOUNT: I think I can add a little to that comment. We were concerned about this, too, particularly in regard to dissolved oxygen, which in the case of fish is a very critical thing. We ran a series of acute toxicity tests in which we exposed fish to endrin and to different levels of reduced, dissolved oxygen. At the time of death or at the end of the experiment, we then measured the amount of endrin in the blood.

We exposed bullheads to a range of from a half ppm on up to about 6 ppm of oxygen. We found at 6 and 4 ppm there was no detectable difference in the survival time or in endrin concentration in the blood at the time they died. However, at 2 and 1 ppm, you could detect much more rapid development of toxicity. That is a complicated way of saying the fish died sooner, but the amount of endrin in the blood was exactly the same as at 6 ppm of dissolved oxygen. However, at one-half ppm where the controls also died—that is, where we had a level of oxygen that was lethal as well as the presence of endrin—there was a reduced amount of endrin in the blood at the time of death. So whether you can say the fish died of endrin or oxygen, I don't know, but nevertheless, it did not show up in the amount of endrin in the blood.

I am not a mammalian toxicologist, nor do I know much about birds, but because we have had very good success with working with the blood of fish, I strongly urge you people who are concerned with determining the effects of these pesticides on other animals to take a look at the blood. I believe that you will find many of these great variations that we are now finding in the tissues will disappear.

At least, I am convinced that fish do not store endrin in the blood. They do not store dieldrin in the blood. They do not store DDT in the blood. If you can get away from this storage business when you are trying to assess the immediate situation in the animal, and particularly a recent exposure, I think that your problems will be much smaller and you will have better success in trying to interpret the data you get.

Now again, I am not telling you how to do it because I don't know how mammals and birds respond, but I do know in the case of fish, it is not uncommon at all to see fat deposits over the hind brain, which must equal 15 to 20 percent of the brain weight, and I cannot see how measuring pesticide levels in the brain of a fish could tell you very much about the well being, the physiological state of the fish.

This fat storage probably may not apply to birds but it does with fish, and again this is not to imply that these other residue levels are not important. They

surely are from the standpoint of the food chain and so on, but in trying to assess the physiological response or status of the animal, I believe, the blood is a good place to look.

DR. STICKEL: Dr. Mount, I agree that your results of the blood certainly appear to be very satisfactory. There have been some few similar studies of mammals, and they just have not worked out as well.

In contrast, the brain in higher animals has proved to be very satisfactory in that the residue levels do not appear to be related either to dosage level, time of exposure, or any of these other things that tend to make it difficult to establish a diagnosis.

You see, with animals collected in the field, you have no idea how long they have been exposed, or what dosage they have been exposed to. In fact, some of the living animals have more residues than the dead ones. In the brain, and in other studies of the liver, there has been a gross difference. There has been no question but what the liver also could be used in diagnosis.

We have felt that we got most consistent dosage-related responses in the brain. I don't know anything about fish, but I have always wondered why the fish people didn't look at the brain. [Laughter]

DISCUSSION LEADER DUSTMAN: That is a fair enough exchange, don't you think? We thank Dr. Stickel and Dr. Mount for their comments.

Are there any other participants in the audience that would like to ask a question?

DR. TONY PETERLE [Ohio]: I would like to direct an unfair question to Mr. Keith. There was a recent publication that implied that there is a possibility for conversion of DDT to DDD. This was related to the Clear Lake incident where the author implied perhaps the concentration in the food chain in Clear Lake was not the result of the DDD applications alone. I wonder if you or Mr. Hunt could add any comments on this recent publication.

MR. KEITH: The finding of DDD residues, three D's residues, certainly indicates that the original material could have been different from DDD. Indeed, it might have been DDT that was metabolized and finally identified as DDD.

I don't see how anyone can back up and take a look at the Clear Lake situation and make heads or tails out of it. Indeed, there might be much DDD in Clear Lake that is the result of the metabolic breakdown of DDT.

Certainly the most obvious source of DDD was the applications made to the lake.

DISCUSSION LEADER DUSTMAN: Thank you, Mr. Keith. Is there anyone else? This has been a very stimulating discussion. We wish to thank you. I will turn the podium back to Dr. Hickey.

CHAIRMAN HICKEY: I would like to thank our panel speakers very much and adjourn the meeting.

# TECHNICAL SESSION

Tuesday Morning—March 15

*Chairman:* JOHN R. WOODWORTH  
Director, Idaho Department of Fish and Game, Boise

*Discussion Leader:* WILLIAM H. LAWRENCE  
Weyerhaeuser Company Forest Research Center, Centralia,  
Washington

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## FOREST AND RANGE RESOURCES

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### USE OF WOODY BROWSE BY WHITETAIL DEER IN HEAVILY FORESTED AREAS OF NORTHEASTERN UNITED STATES

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*U. S. Forest Service, Upper Darby, Pennsylvania*

Most of the management work with whitetail deer has centered on providing an adequate supply of woody browse, based on the assumption that this species is more of a browser than a grazer. Browse is defined as "Twigs or shoots, with or without attached leaves, of shrubs, trees, or woody vines" (Mosby *et al*, 1963). In the present paper, browse refers to woody twigs without the leaves attached.

Our purpose here is to (1) point out the relative importance of different species of woody plants to the whitetail deer, and (2) to assess the role of browse in the deer's year-round diet. Data were collected during deer habitat surveys on six national forests in the Northeast. A previous paper (Shaw and Ripley, 1966) used the same surveys to discuss how timber management activities can be programmed to produce a sustained supply of woody browse for whitetail deer.

The six forests surveyed are:

White Mountain  
Green Mountain

New Hampshire and Maine  
Vermont

Allegheny	Pennsylvania
Monongahela	West Virginia
George Washington	Virginia and West Virginia
Jefferson	Virginia

These forests are located in the most heavily wooded sections of the six states involved. Here, you would expect greater use of browse than in sections which are more intermixed with agricultural lands. Within the boundaries of the combined national forests are 7.3 million acres, of which 3.8 million acres are in federal ownership. Ninety-five percent of this federal ownership is forested. Broad cover types include hardwoods 75 percent, hardwood-conifer 15 percent, and conifer 10 percent.

#### THE SURVEY

Field work was done in a three-year period starting in 1961. Permanent plots or transects were established systematically on each of 32 ranger districts. Each 3,000 to 5,000 acres of national forest land was represented by a cluster of two or three transects. Each transect was 50 feet long and 26 inches wide. All twigs between one and five feet from the ground which showed an inch or more of current annual growth were considered available to deer and recorded as browsed or unbrowsed. There was a total of approximately 2,000 transects established on the six forests. A complete description of methods used is given in Wildlife Management Field Guide (Shaw and Stiteler, 1962).

#### PRODUCTION VS. UTILIZATION

On all six Forests combined, we recorded a total of 106 species or species groups of woody plants. Only six of the 106 species were not browsed at all. Twigs from these unbrowsed species made up only 0.3 percent of the total twigs available.

Thirty-two species and species groups occurred in sufficient abun-

TABLE 1. TWIG PRODUCTION AND UTILIZATION

National Forest	Production (twigs per acre)	Utilization (percent)
Allegheny	17,049 ± 2,961 <sup>1</sup>	15.9
Green Mountain	27,432 ± 2,077	5.5
White Mountain	39,500 ± 1,473	6.3
Monongahela	37,581 ± 3,131	1.6
George Washington	44,782 ± 2,948	6.0
Jefferson	55,100 ± 3,384	2.4

<sup>1</sup> Calculated standard error of mean.

dance to comprise at least one percent of the total twigs available to deer on one or more of the national forests. Twig production, like utilization, varied considerably among national forests.

Species of no value for timber production provided most of the twigs browsed by deer. On five of the six forests, 85 percent of the browsing occurred on noncommercial species, which made up 71 percent of the total available to deer. The one exception was the White Mountain National Forest where noncommercial species provided 53 percent of the browsed twigs. However, on this forest, twigs of noncommercial plants made up less than 25 percent of the total twigs available because of the high proportion of conifers. As would be expected, sprouts were favored over seedlings. Eight percent of the twigs of sprout origin were browsed compared to 3.6 percent of twigs of seedling origin.

#### PALATABILITY

Palatability is expressed here as a browse index. This is the ratio of twigs browsed by deer to total twigs available to deer. An index of 1.0 indicates that the twigs of the species are browsed in direct proportion to their availability. Hill (1946) and Webb (1959) have previously used this method to assess browse palatability.

Browse indexes of the 32 species and species groups that comprised 1.0 percent or more of the total supply of twigs can be grouped into three classes (Table 2). Eleven species had browse indexes over 1.0 on all Forests where they occurred, 10 species had browse indexes split fairly evenly above and below 1.0, and 11 species had browse indexes which consistently fell below 1.0.

Regionwide, greenbrier (mostly common), birch spp., hobblebush, blackberry-raspberry, mountain maple and flowering dogwood showed the heaviest browsing. Locally, other plant species were browsed heavily enough to be considered highly palatable. Black cherry was browsed heavily on the Allegheny National Forest where it was the most abundant, but browsing on cherry was more nearly at random or negligible on the other forests which had less of this species present. Red maple was used more in the northern part of the Region than in the southern part.

Mountain laurel—considered toxic to deer in southeastern United States—was used lightly on the Jefferson National Forest and moderately on George Washington and Monongahela National Forests. The oaks as a group were used very lightly. Beech was used fairly heavy on the Monongahela and Allegheny National Forests, moderately on the White Mountain National Forest, and lightly on the Green Mountain National Forest. Sugar maple, like red maple,

TABLE 2.—BROWSE INDEX SUMMARY.

Species <sup>1</sup>	White Mountain	Green Mountain	Allegheny	Monongahela	George Wash.	Jefferson
Greenbrier spp.				12.2	4.1	6.7
Birch spp.	4.1	2.6	4.8	2.7		
Hobblebush	2.6	3.6				
Blackberry-Raspberry	2.1		1.2	1.3		3.5
Mt. Maple	2.3	2.1				
Flowering Dogwood				3.1	1.3	1.6
Chestnut				1.4	1.6	1.2
Sassafras					1.7	1.1
Sourwood						2.4
Fringe Tree			1.4			
Black Cherry			1.3			
Azalea spp.				4.0	0.8	1.5
Striped Maple	3.4	1.3	0.7	1.1		
Red Maple	3.4	1.2		1.1	0.5	0.8
Blueberry spp.	1.4			0.5	1.6	1.6
Beech	1.0	0.6	1.2	1.3		
Sugar Maple	1.3	1.7	0.5	0.8		
Juneberry		0.8	2.5	0.6	0.9	
Witch Hazel			2.5	0.2	0.7	0.2
Viburnum spp.			0.5		2.4	
Oak spp.				1.0	0.7	0.2
Black Gum					0.9	
Mt. Laurel				0.9	0.7	0.1
Aspen			0.8			
Deerberry				0.5	0.5	0.6
Hemlock	0.6		0.1			
Common Alder		0.5				
Pine spp.					0.4	
Hornbeam			0.3			
Balsam fir	0.2	0.1				
Hophornbeam			0.1			
Red Spruce	0.1	0.1				

<sup>1</sup> Species comprising 1.0% or more of the total twigs available to deer.

was used heaviest on the northern forests. The blackberries and raspberries were heavily used wherever they occurred, and their importance as a summer food (leaves and berries) should be stressed. Red spruce, balsam fir, and hemlock all had very low browsing indexes, but it should be pointed out that the quantity of twigs eaten was still a substantial part of the total twigs consumed.

On the White Mountain National Forest, where more than 65 percent of all twigs available to deer were conifers, each of the important hardwood species had a browse index of 1.0 or greater.

#### ROLE OF BROWSE IN TOTAL DIET

The average oven-dry weight of twigs consumed by deer was determined, using the method developed by Shafer (1963).

It is obvious that deer are consuming large amounts of something besides browse. Other investigators have come up with the same deductions. In mixed-oak stands in Pennsylvania, Watts (1964), using captive deer free to select their own food, observed a significantly



TABLE 3. ESTIMATED ANNUAL FOOD CONSUMPTION

National Forest	Total food required per acre per year (lbs.) <sup>1</sup>	Browse consumed per acre per year (lbs.)	Percent of browse to total food intake
Allegheny	23.67	1.79	7.6
White Mountain	9.12	1.56	17.1
Green Mountain	23.25	1.00	4.3
Monongahela	16.54	0.44	2.7
George Washington	25.33	1.77	7.0
Jefferson	18.66	0.90	4.8

<sup>1</sup> Based on 2.5 pounds (dry-wt.) per 100-pound animal

higher preference for dry leaves during winter than for woody browse.

Dunkeson (1955) reported that herbaceous plants supplied a large proportion of the deer forage throughout the year in Missouri Ozarks. In Arkansas, Crawford and Leonard (1963) found that an inverse relationship exists between oak mast yield and utilization of woody twigs. Lay (1965) in a study of fruit utilization by deer in the forests of eastern Texas concluded that, "The range with a large variety of hardwoods of fruit-producing sizes contributes more to the deer diet than the one which offers little but browse."

All this evidence suggests that habitat managers should give more attention to grasses and other herbaceous plants as winter food for whitetail deer in the Northeast. Since these plants are usually associated with summer and transitional spring and fall food rather than winter, it follows that improved summer range should automatically enhance the winter food supply.

Over most of the deer range in the heavily forested areas of the Northeast, woody twigs probably make up less than 10 percent of the total weight of food consumed by deer in the course of a year. Deer yards of the far north would be an exception as indicated by the 17.1 percent shown for the White Mountain National Forest in Table 3.

#### MANAGEMENT IMPLICATIONS

The problem of regenerating commercial timber species, where deer are known to adversely affect survival, can be alleviated by maintaining a stocking of noncommercial species in the young stands. Careful planning to allow for this buffering effect of noncommercial species should greatly enhance the chances for more successful regeneration of desirable species.

Browse makes its greatest contribution to the food needs of white-tail deer in the Northeast during the winter months from January through March, especially where snow normally covers the ground.

Efforts to provide additional browse should take this into account, giving special consideration to the proximity of winter concentration areas.

The browse index summary can be used to select indicator species as a basis for studying trend of range utilization. Each Forest has several species that qualify in meeting the minimum requirements such as palatability, abundance, and uniform distribution.

Deer range improvement plans should give increased attention to food sources other than browse, particularly herbaceous plants that retain some green leaves throughout the winter, oak mast, and fruits of other plants.

#### SUMMARY

We can conclude from these surveys that a few species of woody plants are consistently eaten at rates exceeding their occurrence, but the majority of species are eaten more nearly at random. Locally, there exists a close relationship between use and availability. In nearly every case, the species that occur in greatest abundance are the ones most often eaten. To state categorically that a particular plant species is highly preferred browse can be misleading. Actions and interactions by deer, man, and other forces of nature influence the composition of vegetation. A deer's food habits appear to be as variable as the vegetation. The kind of plants present at any given place and time will determine in large measure what and how much deer will eat.

A relatively few species make up the bulk of twigs eaten on any particular Forest and most often these were species of little or no commercial value. Knowledge of these relationships will greatly enhance the opportunities to achieve better coordination between timber and wildlife programs.

The concept that browse is the principal food of whitetail deer in the Northeast is open to serious question. Results of these surveys indicate that the use of woody twigs for food by whitetail deer in the Northeast is inversely related to availability of other winter foods.

A better understanding of the following items is needed to do a better job of managing whitetail deer.

1. The importance of summer range in fulfilling the total yearly requirements of whitetail deer.
2. The minimum woody browse requirements of whitetail during the late fall, winter, and early spring months.
3. The nutrient value of these winter food items.
4. The foods, other than woody browse, eaten by whitetail deer.

These surveys have provided us with a new insight for evaluating the whitetail range. The surveys also emphasize the lack of certain basic knowledge of the food requirements and habits of the whitetail deer. As the demand increases for more intensive management of whitetail deer range on public lands in the Northeast, it is apparent that more knowledge of yearlong food requirements is needed.

## COMMON AND SCIENTIFIC NAMES USED

Aspen spp.	<i>Populus</i> spp.
Azalea spp.	<i>Rhododendron</i> spp.
Balsam Fir	<i>Abies balsamea</i>
Beech	<i>Fagus grandifolia</i>
Birch spp.	<i>Betula</i> spp.
Blackberry-Raspberry	<i>Rubus</i> spp.
Black Cherry	<i>Prunus serotina</i>
Black Gum	<i>Nyssa sylvatica</i>
Blueberry spp.	<i>Vaccinium</i> spp.
Chestnut	<i>Castanea dentata</i>
Common Alder	<i>Alnus rugosa</i>
Common Deerberry	<i>Vaccinium stamineum</i>
Flowering Dogwood	<i>Cornus florida</i>
Fringe Tree	<i>Chionanthus virginicus</i>
Greenbrier spp.	<i>Smilax</i> spp.
Hemlock	<i>Tsuga canadensis</i>
Hobblebush	<i>Viburnum alnifolium</i>
Hophornbeam	<i>Ostrya virginiana</i>
Hornbeam	<i>Carpinus caroliniana</i>
Juneberry	<i>Amelanchier canadensis</i>
Mt. Laurel	<i>Kalmia latifolia</i>
Mt. Maple	<i>Acer spicatum</i>
Oak spp.	<i>Quercus</i> spp.
Pine spp.	<i>Pinus</i> spp.
Red Maple	<i>Acer rubrum</i>
Red Spruce	<i>Picea rubra</i>
Sassafras	<i>Sassafras albidum</i>
Sourwood	<i>Oxydendrum arboreum</i>
Striped Maple	<i>Acer pennsylvanicum</i>
Sugar Maple	<i>Acer saccharum</i>
Viburnum spp.	<i>Viburnum</i> spp.
Witch Hazel	<i>Hamamelis virginiana</i>

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## WILDLIFE AND FOREST PROBLEMS IN APPALACHIA

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West Virginia, in common with the rest of the Appalachian highlands, has problems of poverty, unemployment, and depleted and mismanaged resources. But in the region south of the Kanawha, in the Cumberland Plateau of southwestern West Virginia and eastern Kentucky, the heart of Appalachia, the problems are magnified. Here poverty is more grinding, unemployment more severe, the resources more ruthlessly exploited, and the landscape more scarred. The degradation of land resources and people in this area is reflected in the high incidence of forest fires and the extreme scarcity of wildlife. Both are indicative that the region is ill, socially and ecologically.

Annually hundreds of fires sweep over the steep slopes and narrow ridges of the Cumberland Plateau region. Associated with the fire problem are a disregard of conservation laws and law enforcement, reckless mismanagement of resources, water pollution, and a large human population out of proportion to the economy. This plateau country is a region of great timber-producing potential but of lower timber production, a region of high wildlife potential but of low wildlife populations.

To assess the resources problem and to arrive at some solution to the fire and wildlife problems were the objectives of a research project initiated in 1959 and concluded early in 1965. It involved an effort to interest a coal company in wildlife management and a sportsman's club in assuming a cooperative role in the management of land for wildlife. The study also included an examination of the underlying problems that involved the social, cultural, and economic conditions and the history of the region. The problems, impressions

gained from the study, and an analysis of the situation are the subjects of this paper.

#### THE PROBLEMS

##### *The Country and the People*

A saying in the Mountain State goes: "There is West Virginia and there is the country south of the Kanawha." A good deal of truth is contained in this statement, for the country south of the Kanawha River is different from the rest of West Virginia. Physiographically, ecologically, socially and culturally, southwestern West Virginia is more akin to eastern Kentucky than to the rest of the state.

The region goes by several names such as the Allegheny Plateau (Fenniman, 1938), and the Low Hills and Rugged Eastern Area of Allegheny and Cumberland Plateau (Braun, 1950). But ecologically, the country south of the Kanawha shows a stronger affinity to that of the Cumberland Mountains than to the rest of the Allegheny Plateau. For this reason the area will be called the Cumberland Plateau.

The country is a peneplain, strongly dissected by a dendritic drainage pattern. The elevation ranges from around 600 feet in the extremely narrow valleys to 2700 feet along the narrow ridge tops. The hills rise abruptly from narrow stream bottoms—with slopes ranging up to more than 85 percent—and the ridges drop off sharply. The narrow valleys, rugged terrain and remote hollows effectively isolate both families and communities, make transportation difficult, and inhibit activities associated with education and community life.

Appalachia was settled early. From 1750 to 1775 the ancestors of some of the southern highlanders left coastal Virginia and Carolina for the foothills of the Appalachians. The population grew, and new immigrants, largely Scotch-Irish, arrived by the way of the Wilderness Road newly cut through the Cumberland Gap and filtered down through southern Pennsylvania and Ohio. To seek the isolation they desired, many people moved deeper into the hills, back along the creek branches and up along steep hillsides where they eked out a living. They carried with them the more primitive methods of building and farming; and they passed the same skills and the same attitudes, reinforced by isolation, lack of education, and inbreeding, from one generation to another. A good deal of the heritage and the attitudes still exist in Appalachia today.

##### *Fire*

The prevalence of fires is so great in southwestern West Virginia that this region has been called the hot spot of the state. Over the

years the number of fires and the total acreage burned in this area has been much greater than in the rest of the state. In some years, the southern portion of West Virginia may experience 20 times as many fires as northern West Virginia, with 50 times more acreage burned.

### *Dogs*

Every community has its dog problems; but nowhere are dogs more abundant and the problem more acute than in the Cumberland Plateau of West Virginia. Because the villages and rural residences are situated in small valleys surrounded by forests, and because few dogs are restrained from running freely, the animals have easy access to the forest. In fact in roadside counts of dogs, the highest number of dogs per mile occurred in very remote areas where human habitations were few.

These dogs, breeding at will and raising their young in the woods, are a constant menace to deer. Through harassment and predation, dogs take a heavy toll of deer, and inhibit the increase and spread of the deer in this region. In areas where dogs are controlled, deer increase. This is well illustrated by the situation in Clear Fork, Dry Fork and Panther Creek country in McDowell County, West Virginia. With dogs under control, the herd in 1950 was estimated to be around 1500 head; during the 1953 season, 432 deer were taken from the area. The deer population is steadily increasing.

The dog problem exists because of public apathy for the dog laws, which are adequate to control the situation, and a highly protective attitude toward dogs. For example, in one southern West Virginia county 1000 dogs, only a fraction of the population, were licensed in 1952; in 1953 the number dropped to 20; in 1963 only 63 dogs were licensed. Shooting a dog, even a feral one, is abhorred by most highlanders. The dog, in effect, is the "Sacred Cow" of Appalachia.

### *Poaching*

Poaching, too, takes its toll of wildlife, and in fact leads the causes of non-seasonal mortality of deer (although loss from dogs is undoubtedly higher). The southwestern part of West Virginia is a highly populated area where poaching is the rule rather than the exception. The amount of poaching is somewhat related to the amount of unemployment in the area. During the 1940's when coal strikes were widespread in the region, idle miners increased their poaching activities. The current heavy unemployment and poverty also encourage poaching to add some meat to the diet.

Poaching, however, is a way of life. The heaviest squirrel hunting takes place in July when the mulberries are ripe. Even the best of sportsmen admit that poaching is widespread, and among them there is considerable agitation for the state to open squirrel season as early as July, and certainly no later than September, to give the "honest sportsmen" a chance.

### *Scarcity of Game*

As a result of dogs, poaching, and, for some species, the deterioration of range, game is scarce in the Cumberland Plateau. The white-tailed deer is very scarce, although the region in general contains some of the finest deer range in the state. Bear are gone. Wild turkey, once fairly plentiful (Williams, 1919) have been reintroduced, but it is too early to tell if the flocks will increase. The gray squirrel, extremely abundant in the past, is the most popular game animal in the Cumberland Plateau, but populations are spotty. Short cutting cycles and "hot" fires have converted timberlands into young stands that cannot support high populations. The raccoon, abundant throughout most of West Virginia, is very scarce in this region. Sportsmen clubs have restocking programs of their own, purchasing the animals from out-of-state for \$5.00 each. In addition the Department of Natural Resources periodically restocks hundreds of 'coons in the area. In spite of all this, the population remains low. The ruffed grouse is probably the most abundant game animal. Although there is little interest in hunting it, the grouse offers real potential as a game animal in the Cumberland Plateau. The bobwhite quail and the cottontail rabbit in an earlier day inhabited the stream bottoms and the open hillsides of southwestern West Virginia. With the decline of subsistence farming on the hillsides, the forest has taken over and the natural habitat for both quail and rabbit has disappeared. As a result, both bobwhite quail and cottontail rabbits are scarce, although interest in hunting them remains high.

### AN ANALYSIS OF THE PROBLEMS

The forest and wildlife problems in the Cumberland Plateau are complex ones. They are a product of history, of customs and beliefs, of economic situations and social conditions, of individualism, of isolation, of revolt against imaginary and real wrongs. The problems have no simple solution.

The roots of the problems extend far back into history. As explorers and settlers moved into the mountains, they discovered that the Indians had settled the region ahead of them. There were large areas of cleared land, some once used for crops, others given to the grow-

ing of grass that supported the herds of elk and buffalo (Beverly, 1722; Boyd, 1929; Dunnington, 1893). These openings were maintained by fire. In addition, wildfires, started from Indian campfires and from the fires set by natives to drive game, devastated vast tracts of mountain country. As a result the region held its share of elk and buffalo, especially in the narrow valleys of the Kanawha, the Big Sandy, Tug Fork, and Pigeon Creek.

Around 1672 the Iroquois swept the region between the Allegheny Mountains and the Ohio River, destroyed Indian settlements, killed and drove away the inhabitants or incorporated them into their own tribes. Thus for 100 years the Cumberland Plateau remained unpeopled, and the forest grew undisturbed.

Then the settlers moved in. Most of the people possessed little knowledge of agriculture. What they knew they learned chiefly from the Cherokee Indians. They built their first cabins Indian style, small and windowless, but attached a chimney. They cleared the land Indian style by burning or deadening the timber and planted squash, corn and beans (see Campbell, 1921; President's Message, 1902). In some ways they even shared the Indians' propensity for dogs, since they brought with them as many as a dozen or more ill-tempered mongrels to a family. The early highlanders depended upon wild game and fish for their protein. As the game disappeared, they relied more and more on their hogs and sheep, which they turned loose in the woods.

In the late 1800's two developments had a profound effect on the forests of the region. One was the discovery of the rich timber stands by the eastern lumber industry; the other was the exploitation of coal. These two, in hand with the ignorance of the highlanders, destroyed the timber wealth of the Cumberland Plateau.

Around 1870 eastern lumbermen, attracted by the magnificent timber coming out in small quantities from the plateau country, moved in and bought up both timber and mountain land. In doing so their agents discovered that the highlanders were holding land for which they had no legal title. Sensing the golden opportunity, the lumbermen sent in surveyors to claim land that had not been formally patented and started a period of wildcatting. Survey teams began at the mouth of streams and worked up the coves. Their surveys embraced immense areas of land, including farm land legally owned by the mountaineer. The highlander went to court; but more often than not the court ruled that the wildcat claims were valid, including all intervening land. Thus the mountain country was patterned with a welter of conflicting land claims involving mountaineers, timber companies and later coal companies. Eventually



the court fights stripped the highlander of land that made him independent and drained him of all the small financial resources that he had. Meanwhile the timber companies began their onslaught on the forest. Forty years later only a pitiful remnant of cull and second-growth timber remained.

With the lumbermen came fires, more destructive than ever. If the Indians burned, at least the fires they set fed only on the current leaf fall and debris. But the lumbermen left a mountain of debris that provided fuel for highly destructive fires that spread into surrounding uncut forests.

Like the timber companies, the coal companies found large areas unpatented and began to stake their claims. They also began to buy out the holdings of the highlanders; or if unable to do so, they leased the coal rights, usually on terms so favorable that the buyer was allowed to pillage the land and leave the title and the ruined landscape with the mountaineer. Many of the highlanders who sold their land left for the city. Failing to find jobs and security, or growing homesick for the hills, they returned to live as squatters in the cabins and on the land they no longer owned. Some were chased off, others were allowed to stay.

By the early 1900's, coal and timber companies, chiefly the former, controlled close to 70 per cent of all the land in the Cumberland Plateau of West Virginia and the mineral rights to most of the rest. The fate of the forests was effectively removed from the highlander and transferred to corporations whose chief interest in timber was its exploitation rather than its management for sustained production. The highlander in turn had little regard for the forests held by absentee owners who had no concern for the forests, the wildlife, or the people.

A pall of smoke has always hung over the Cumberland Plateau. It still hangs there today, in part because it is an inherent aspect of the region. The highlander has always burned the woods, if not to clear away the forest, then to open it up a bit, just as the Indian before him burned it. The early highlander learned from and thought like an Indian. And "The Indian," wrote Maxwell (1910), "is by nature an incendiary, and forest burning was the Virginia Indian's besetting sin." The highlander quickly adapted his ways. Burning kept the woods open, which made it more difficult for an enemy or a feuding faction to pull off a surprise attack.

These days are history, but the ingrained habit still remains. The highlander still likes the forest open with no understory. When the sprout and underbrush reappear, when the litter and debris build up, the time has come for the highlander to clean up the woods. This

pendant for an open woods, however, is not confined to the highlander alone. It is common among many people. Removal of the undergrowth in parks, along roadsides and on estates is a common practice. The only difference is that the highlander uses fire as his tool instead of scythe and brush hook.

The highlander burns to get rid of snakes. That burning is only going to open up the woods to warm sunlight sought by snakes, that it will encourage herbaceous growth to bring in mice, a major item of food for the snakes, never enter the highlander's mind. The only defense he feels that he has against snakes is fire, so he employs it.

The Indian used fire as a method of hunting; so does the mountaineer. He does not go as far as emulating the Indians' practice of burning acres of forest to drive game out of hiding; but he does use fire to force squirrels and raccoons out of trees. The method is simple and effective, but the results are often disastrous. That such a method of hunting is illegal is meaningless to the residents of the Cumberland Plateau.

In fact, there exists among the mountaineers a general hostility for the law, an attitude reflected in the number of fires and the intensity of poaching. The facts that laws against setting fires and burning debris during specified periods do exist in West Virginia and that the burning of the property of another is a criminal offense carried no weight at all. For 200 years, at least, the law in the Cumberlandlands has been a matter reserved to the family. Reared in isolation, self-reliant to a degree seldom approached anywhere else, giving undying fealty only to family and kin, and totally lacking any community spirit, the highlander recognizes few laws except those he sets for himself.

The highlander even today does not accept, or accepts only reluctantly, any form of law enforcement or any law enforcement agent. The conservation officer is as much of an enemy as the revenue officer. If the mountaineer feels like burning a woods, he burns it as if expressing his disdain for laws written down for him by strangers miles away.

Strong fealty toward their kin reinforces the highlander's anti-law attitude. If a member of his family or one of his immediate relations is guilty of an infraction of the law, the highlander applies no social pressure on him to stop. Indeed the family will go out of its way to protect, defend or hide the culprit, regardless of whether he is right or wrong. Thus those who set fires or poach game have little fear of discovery.

Incendiarism is a reflection of depressed social conditions, especially for the young. This was noted by F. Fraser Darling (1951) in

his study of the West Highlands in Scotland where burning of the heather is a problem. It is also true in the Cumberland Plateau. Inhabiting remote and narrow valleys, living in a region of grimy, half-abandoned towns short on recreational opportunities, deprived of fishing by pollution, disinterested in hunting because there is little to hunt, the young have nothing to satisfy their social urges. So boys, particularly of high school age, set the woods on fire for the sheer excitement it provides. That it is the young (and older mental defectives) who set the majority of wildfires is a well-known fact among the highlanders, but their identity is hidden by close filial ties.

The average highlander has little regard or concern for his forest environment. It has been so much a part of his life that he takes it for granted. Furthermore, the forest doesn't belong to him, and exactly what happens to the forest and the way it is managed are far beyond his immediate control. His squirrel woods of today may be cut for lumber tomorrow; or his hillsides may be buried under the rubble of strip mine overburden. The mountaineer has seen his land, legally claimed or not, taken over by mining and timber interests. He has been reduced to a squatter on land that he once owned. In many cases he has traded his forest cabin and his hillside garden patch for a little bigger house in a grimy coal town. He has seen his peaceful hollows filled with "aliens," people from far outside the region brought in to help mine coal. From mining regions themselves, these new residents had no knowledge of and even less regard for forests.

With the advent of the coal town, the highlander saw an element of government and law coming into the hills. Only this government was dominated by coal bosses who ran the town as they saw fit, taxed themselves as they wished, offered what educational opportunities they cared to and nothing more. Political offices were and still are bought and sold. The highlander himself was something of a bystander; he had very little to say in the running of his own affairs. He became economically and socially subservient to his new master, coal.

The lot of the highlander has always been spartan. He does without much and gets along on very little. His first interest in life has simply been survival. People living under such conditions rarely are concerned about the state of natural resources about them. In fact, the whole conservation movement is common only to more ordered, more affluent, more highly educated societies who wish to maintain what they already have. Although it is what they desperately need, impoverished classes seldom consider conservation. Poverty and poor resource management seem to travel hand in hand.

To the highlander the prevention of forest fires has no economic significance. He cannot be sold on the commonly used argument that the prevention of fire means more game, when game is already virtually nonexistent; or that forest fires result in stream pollution when streams are already deadly to life; that timber means prosperity when another abundant source, coal, also is supposed to mean prosperity, and it doesn't; or that forests should be managed for posterity when his own immediate future appears as bleak and as hopeless as his past has been. Under current economic and social conditions, the old cliché, "Prevent Forest Fires," is so many meaningless words to a people whose first major concern in life is where the next meal or the next pair of shoes is coming from. Fewer fires do not mean more food on the table; nor does the disappearance of the pall of smoke necessarily carry away with it the air of hopelessness that hangs in the narrow valleys.

All this has had its effect on the highlander. The collapse of the coal industry as a major source of employment has forced the highlander onto the relief rolls. The once self-reliant practice of living on home-grown pork, corn, and "shucky beans" was shattered by the cash economy of the company store. The welfare state has demoralized the mountaineer and the relief check has become a way of life. The highlander lost his pride and accompanying this loss, helped along by growing slag pits and grime, has been a decline in the physical appearance of the region. The highlander has become content to live in a pile of debris and has lost the friendship he once had for the coal companies. Under such conditions, there is no incentive for the mountaineer to worry or care about the fires burning around him. Thus it is that the fires in the Southern Appalachians are symptomatic of the ills of the region.

In an earlier day when the settler lived on the fringes of the wilderness, hunting was chiefly subsistence. Although the hunter undoubtedly enjoyed the hunt, his primary motive was meat for the table. As the wilderness receded and game became scarce, as towns grew, as agriculture flourished and the economy prospered, people no longer depended upon wild game for food. Beef, pork, and chicken replaced venison and squirrel. Hunting as a part of a way of life ceased and became instead a sport and a form of recreation. The sportsman, riding on a wave of the conservation movement, became interested in the management of game as a means of improving and perpetuating his sport. Subsistence hunting died or was legislated out of existence.

But this historical trend never took place in the Cumberland Plateau and other isolated areas in the southern Appalachians. The highlanders still live as subsistence hunters.

As towns grew in response to a developing coal industry, a new class of people entered the region, some of whom formed the nucleus of sport hunters. But since sport hunters, in general, are not willing to spend excessive time and energy in the pursuit of scarce game, they travel to areas of greater abundance to hunt. Thus a strong interest in local sport hunting has never really developed in the area in spite of the presence of some sportsmens' organizations.

Because of the low level of prosperity in the regions and the scarcity of money to buy meat, the bulk of hunting in the Cumberlandlands is still subsistence. Unemployed, able to live on welfare commodities and some garden vegetables as the basic diet, the highlander can devote an excessive amount of time and energy to hunt down scarce game. Since he ignores the game laws that can be only loosely enforced, he hunts whenever he pleases, especially when he craves some meat. Thus it is that hunting is heavy in July and August when the squirrels are seeking mulberries and are easy to shoot, that raccoons last so short a time, and that the deer herds can hardly get a start. The highlander's chief interest in game is food, not a source of recreation. Only in an affluent society is hunting a sport and a form of recreation.

The approach to forest fire prevention and wildlife conservation in the Cumberlandlands has followed traditional methods used successfully in other regions of the United States and in areas of West Virginia, but it has not worked in the Cumberland Plateau.

There are reasons why. The complete lack of community cohesiveness and spirit negates any of the usual appeals to a sense of responsibility for the property of others, for the welfare of the community, or for natural resource conservation. Further, the lack of education and poor education reduce the effectiveness of the printed word as a means of implanting the ideas of forest fire prevention and wildlife conservation into the mind of the highlander.

The people of Appalachia have not been exposed to the philosophy of conservation as have those in other parts of the state and the nation. For years Appalachia has been outside of the mainstream of progress and change, of ideas, and education. In the 1930's the conservation movement spread over the country, but its influence was hardly felt in the Cumberland Plateau. For all practical purposes the region might not have existed, for it received little attention from the governmental and private organizations. The whole tenor of the region was one of open exploitation instead of sound resource management, wildlife, forest and water conservation. Only within the past ten years has any conservation philosophy begun to develop in the region and its continued development will be slow, for conservation is alien to southern West Virginia.

Depopulation and a distorted age structure of the population add to the problem. The age pyramid for southern West Virginia is top heavy in older age classes and also heavy in the very young. Missing are the most progressive and most responsive groups between the ages of 25 and 45. With the old in power, ancient traditions remain. The old fundamental sentiments, beliefs and values are highly resistant to change. The group that could change them, that could embrace and spread twentieth century ideas, conservation concepts and responsibilities, have left for other regions and other states. Remaining behind are those who cannot make their way in the world on the other side of the ridge.

#### AN APPROACH TO A SOLUTION

The approach taken in this study was, if the highlander were given some opportunity to share in the control and management of forest land for game, then perhaps his attitude toward the land and forest fires would change, and the incidence of fires decrease. The success of such an approach depended upon the interest and the cooperation of a land-holding company and upon the interest and cooperation of a group of hunters or a sportsman's club in acquiring a lease and managing the area. In this study neither the company involved nor the sportsmen gave their support to the extent that was necessary to accomplish the objectives. But out of it came some approaches that could work.

If there is to be any change in the forest and wildlife resource situation in the Cumberland Plateau, then it must begin with those most closely involved in the problems, the landowner and the resident of the region.

The fire problem, the poaching problem, the dog problem, but especially the first, are only symptomatic of the larger social and economic problems. To view the forest fire situation, for example, as something apart, to approach its solution as a separate problem without tying it into a solution of larger social, economic and educational ills, will not reduce fires; indeed it may only create more of them. Spending money in training fire crews and detection systems may bring about earlier suppression and reduce the area burned, but it will not necessarily reduce the number of fires started. Appealing to the people to refrain from setting fires to improve hunting is extremely naive.

The crux of the problem lies in the fact that the coal region is an area of the haves and have-nots. A few large companies own the land and control its utilization. The people do not.

Thus, if changes are to come, then the coal and other land-holding

companies must provide the leadership, since they provide the ownership. To develop such leadership within the coal companies will be just as difficult—if not more so—than changing the ancient attitudes and traditions of the highlander. The coal companies must cultivate a sense of responsibility for the land surface and its timber and a new social consciousness. But through their long history, the coal companies have favored a short-term interest in mineral exploitation to give greatest return to absentee stockholders over a long-term policy favoring sound land management for the benefit of future generations and the welfare of the State.

If the coal companies have a callous disregard for surface acreage, then the highlander can hardly be expected to show any respect for it. One can hardly urge the resident not to burn the forest on on mountainside, while on the other the coal company is burying trees under a rubble of strip mine overburden. On the other hand, respect for land on part of the company engenders similar respect from the highlander.

Such a change will demand that coal companies develop a mentality that is not wholly concerned with the largest possible corporate profits and stock dividends for absentee stockholders who have never visited the region or even remotely know the country their investments are helping to exploit. Even the stockholders will have to change.

A changing attitude on the part of coal company and land-holding corporations will involve more than appreciation and care of their own lands. The companies will have to do something for the resident, to give him some stake in the forests, even if this involves something of a welfare approach. Companies may find it necessary to make some minimal investment of money with little direct return other than the reduction of fires.

This would involve in part the sponsorship and the financial support of sportsmens clubs, for no such local organizations could be financially self-supporting in the poverty-ridden Cumberland Plateau. The companies, coal and timber, would also have to insure that in managing the timber resource, full consideration would be given to wildlife values. In this region such consideration would involve the retention of den and mast trees, for the most popular game animals in this region are the gray squirrel and the raccoon. Failure to manage for these would alienate the residents. In addition the companies should sponsor, or at least financially support, well-organized Boy Scout, Girl Scout and other youth organizations, whose primary objective should be to instill knowledge and appreciation of outdoor resources and to provide recreational outlet for the youth.

Such involvement and interest in the youth, especially the high-school age group, cannot be overemphasized, for it is this age group that is responsible for many of the forest fires. In addition, the companies should be interested in and work for better educational opportunities and improved local government.

Any organized program whose survival depends upon a financial subsidy by a coal or timber company should require some resident participation in habitat improvement and even community work. The habitat work may not be necessary, but it would provide the opportunity and the incentive to get the local residents to take an interest in the forest land, to assume some responsibility in its care, and to participate in the planning of the improvement work involved. In this venture, the full cooperation and visible interest in projects must be given by the management of the company; and technical assistance must be forthcoming from the State conservation departments.

Such an approach on the part of coal and timber companies might reduce the number of fires set. Although it may look good on paper, even this method of attacking the problem may not be successful. Beyond requiring a change in attitude of management toward the land, it also demands that the people change. To be successful, a sportsmens club, for example, requires cooperation among its members and a willingness of individuals to devote a few days to club projects. In my experience, such cooperation and willingness to work is not exhibited by a membership that is far more willing to take, to have things done for them, than to give. Among such individualistic people who live in the Cumberland Plateau it is difficult to obtain group cooperation, for such is not a part of the temperament of the people.

Neither would this approach insure more game or better hunting. As long as economic and social conditions remain as they are, there can be little change. The current poverty programs concentrated in this region can, if properly applied, change conditions greatly. Improvement in education and in local government, a substantial rise in the standard of living, reduction of the population through out-migration, restriction of strip mining and a restoration of natural beauty in the region would result in increased wildlife populations, a new attitude toward forest resources and a pride in the region. It is toward those goals that private coal and timber industry, government, both state, and federal, educational institutions and the people themselves, must work. Such changes will take time, perhaps a generation.



## SUMMARY

The Cumberland Plateau of southwestern West Virginia and eastern Kentucky is the heart of Appalachia. Viewed ecologically, it embraces an area where the human is a declining species living in a deteriorated habitat. At its best the land was marginal and harsh; yet it is one of the most beautiful and wild regions in the East. It was capable of supporting a small population of widely spaced, isolated family communities. Then the invasion of the Cumberlands, first by the timber and next by the coal industry, added not only more people but also imposed an exploitative way of life on the land. Carried to its extreme, it damaged both habitat and inhabitants.

The region once held an abundance of wildlife and the finest hardwood timber in eastern North America. Today wildlife is scarce, chiefly because of subsistence hunting and a high feral dog population. Streams are polluted by acid mine drainage, coal wastes, and silt. The forests are second- and third-growth stands, culled by loggers and scarred by repeated fires, largely incendiary in origin. Yet in spite of this, the region represents one of the finest potential hardwood forest areas in the continent and one of the best habitats for forest wildlife. The potential of the region can be realized only when those who own the land—the coal and, to some extent, timber companies—and those who live on the land adopt a new attitude and a new social and ethical conscience. The land-holding companies must assume leadership in developing this land ethic. This would engender a new attitude toward land on the part of the highlander and undoubtedly result in a reduction of fires. Accompanying this approach must be a tremendous improvement in economic, social and educational conditions. As these situations change for the better, poaching should decline, free-roaming dogs may no longer be tolerated and a new air of hope may fill the hollows. Until such changes come, wildlife will be scarce and fires will burn from the hollows to the ridges.

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## DISCUSSION

DISCUSSION LEADER LAWRENCE: I was pleased to hear there were pockets of affluence in Appalachia, although there are somewhat less than there used to be. I am also glad to see the foresters joining with the wildlife profession in discussing forest wildlife problems from the standpoint of habitat and production, food, the effects of browsing and shedding some light on what the forest vegetation means in terms of food preferences. I am sure that as our forest management becomes more intensified we are going to have more intensity in relation to our wildlife management practices.

Again, I speak from my experience in the West. It seems that foresters do control the pattern and distribution of game in their management, and I think the wildlife interests have to recognize this and take notice of some of the habitat changes.

Now then, these two papers are open for discussion.

DR. ROBERT E. GREENBERG (University of Michigan): I would like to ask Dr. Stiteler what methods were used to estimate deer numbers on the forests in the Northeast.

DR. STITELER: Deer numbers of population, as mentioned, were taken from annual wildlife statistical reports submitted by each of the national forests. Now, in arriving at the figure, the biologists on the national forest, in consultation with state biologists, estimated the deer density for each of the national forests, although different methods were used. I am not too familiar with any of them. I don't think any one method was used over the whole region. I don't know whether I have answered your question or not, but that is the situation.

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## DAMAGING DISEASES INVOLVING WILDLIFE

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Most diseases of wildlife are damaging; they may involve only a single wild species, or they may spread from wild to domestic animals and to man. Diseases such as epidemic hemorrhagic disease in deer that affect only wildlife (Trainer, 1964) are the concern of wildlife professionals, and diseases which involve domestic animals or man are of interest to agricultural and public health agencies. Many diseases concern broader groups; rabies is a good example, since its major hosts in the United States are wild animals, it causes economic losses in domestic animals, and it infects man.

There are many examples of diseases of wildlife which also involve domestic animals or man. Pullorum disease (Andrews *et al.*, 1963) infects both wild and domestic gallinaceous birds, as does coccidiosis (Schillinger and Morley, 1942). Anthrax (Anon., 1964) and brucellosis (Fuller, 1961) have been reported from wild and domestic

ruminants and man. Leptospirosis, which has a wide host range in wildlife (Galton, 1959), is a major disease of domestic animals and not infrequently infects man. Ornithosis (psittacosis) associated with human disease has been reported not only from psittacine birds but from snowy egrets (Rubin *et al.*, 1951), and turkeys (Irons, 1951). Antibodies to organisms of the same group as ornithosis have been demonstrated in small mammals, livestock, and man in rural environments (Thorpe, 1965). The viruses of the arthropod-borne encephalitis (sleeping sickness) find reservoirs in wild birds; and given the right ecologic conditions, mosquitos carry the disease to horses and man (Kissling, 1958). The parasitic organism, *Trichinella spiralis* is usually a parasite of swine and man but the organism has been recovered from at least 33 species of North American animals, most of which are wild (Zimmerman and Hubbard, 1964). I have heard of at least one person who contracted the disease by eating bear meat that was not completely cooked.

The need to control the spread of disease in populations has led to the development of a specialized field of disease investigation, epidemiology. An epidemiologist studies diseases and develops means of controlling them. In order to fulfill this task, it is obvious that he must be sufficiently familiar with a disease to identify a weak link in its cycle, and devise means of breaking that link. It is sometimes possible to achieve at least partial control even when the entire cycle is not known, but usually the most practical means of control are developed only when the epidemiology is complete.

Starvation, a disease which occurs in severe winters in our deer herds, is not an infectious disease, but it affords a good example of how epidemiologic principles have been used to arrive at a solution to a disease control problem (that starvation is still a problem attests to the fact that perhaps the best solution has not yet been found). The basic epidemiologic factors are reasonably clear. (1) The population at risk, although not enumerated, can be estimated. (2) Since no immunity exists from previous experience with this disease, the entire population can be considered susceptible. (3) The degree of susceptibility is known to vary and this variation is a function of age as expressed by size. (4) The agent, insufficient nutritious food available under "yarding" conditions, is established. (5) The disease is clearly not contagious, but increasing the population at risk obviously increases the severity of the disease, and results in an increase in the percent as well as the absolute number of those stricken.

The solution appears simple: remove the agent causing the disease. The practical application is more difficult because resources for improving the food supply are totally inadequate. An alternate

solution is really more appropriate: reduce the population at risk by simply reducing the population. The resources available for this task are legion—every deer hunter in the area is a potential helper. But again, experience has taught us that this is not the ultimate solution. Those who do not understand the problem may impose legal restrictions in the form of overly strict hunting laws. Those that might be able to help may have been pre-educated to a degree that they are incapable of assisting; they simply will not harvest fawns, the smallest and most susceptible animals in the herd.

Perhaps the surest way of controlling an infectious disease is to eliminate the reservoir of the infection. This, however, is not always practical, for example the only known reservoir of the virus of poliomyelitis is man.

Brucellosis may be a limiting factor of herd size of American bison (Fuller, 1961) and is a serious disease of livestock. Called undulant fever in man, it is a disease of public health importance. Since this disease is both infectious and contagious, its control is somewhat complicated. Brucellosis in cattle has been largely brought under control after many years of study by means of hard work and lots of money. A vaccine that protects cattle from infection can be administered to calves, and many millions have been vaccinated. A rapid and accurate method of identifying infected cattle has been teamed with slaughter of infected animals to reduce the reservoir of the causative organisms. Pasteurization of nearly all milk destined for human consumption has helped reduce the human infection rate (Held *et al.*, 1958). Today undulant fever is almost exclusively an occupational disease, especially of those working with swine (Harris *et al.*, 1962). Based on the epidemiology of the disease in cattle, it might be possible to eliminate this disease in our relatively small herds of bison. However, without adequate facilities for handling, the techniques used to control the disease in cattle may not be feasible.

Rabies in foxes was recognized in Massachusetts in the first decade of the 19th century, in skunks in Baja, California in 1826. During the mid to late 1800's, skunk rabies assumed epidemic proportions in the Midwest, and later in the West (Johnson, 1959). Now, about 100 years later, we are in the midst of another serious epidemic of wildlife rabies, with cases in skunks or foxes being reported from states on either coast and the Canadian and Mexican Borders. While not a major problem at this time, coyotes have been involved in rabies outbreaks in our western states in the past (Records, 1932). Since 1960, over half of all rabies cases in the United States have been in wild species; in 1964, 75 percent of all rabies cases were in wild animals.

To stress the importance of wildlife rabies, it is felt that less than 10 percent of the true number of cases are reported (CDC data).

Wildlife rabies plays an important part in rabies cases in larger domestic animals. I have participated in the investigation of several outbreaks of rabies in dairy cattle where the only reasonable source of infection appeared to have been a skunk or a fox. In some instances a laboratory diagnosis of rabies was made in the wild animal that bit the stock. In other cases a rabid animal was reported in the vicinity of domestic animals that later developed the disease.

Of all the animals which man commonly maintains in his home, dogs are the most susceptible to rabies. Epidemic dog rabies has been controlled in almost all of the United States; only in those states of the Ohio River Valley and the Mexican Border is epidemic dog rabies a major problem. The total number of cases in dogs for the country has been reduced over 95 percent since 1944. This degree of control has been accomplished by applying a sound epidemiologic principle, elimination of susceptibles. Vaccines today protect dogs, and unowned dogs are destroyed. Strays are clearly of no value and are indeed a hazard to man and his pets alike, for they often carry not only rabies but other diseases of dogs. The means of preventing rabies in dogs is at hand, but rabies will continue to be a threat until it is controlled in wildlife.

Cats are susceptible to rabies, and since our cat population is relatively unvaccinated, wildlife may infect cats as well. In 1964, an outbreak of cat rabies in Tucson, Arizona, was thought to have originated from an infected wild animal (Anon., 1965).

Rabies is still a disease of great importance in the United States. Always fatal once contracted, it is one of the most dreaded maladies of man. Although only one case of rabies has been recognized in humans in this country in each of the past three years, it is estimated that every year about 30,000 Americans are treated following exposure to a rabid animal. In recent years several human cases of rabies have been infected by wildlife (CDC data).

The epidemiology of rabies is far from completely understood, but certain observations have been made. The virus is classically transmitted by the bite of an infected dog, but it is now known that rabies virus from bats may infect carnivores by means other than bites (Constantine, 1962). Today, control of rabies in wildlife is based on the epidemiologic consideration that the virus is transmitted by direct contact, *i.e.*, a bite, and that reducing the population must indeed reduce the chance for contact. Clinically, a rabid animal does not usually seek other animals to bite, but such an animal will bite any animal in its wandering path. Until now, almost all control has been

by means of direct attacks on the target species; the attacks have all been based on the outright killing of the animals. Harvesting skunks for fur appears to have prevented epidemic skunk rabies in the North Central States until pelt prices declined (Parker, 1961). Population regulation of foxes and skunks as a means of rabies control has been successful in some areas (Schnurrenberger *et al.*, 1964), (Linhart, 1960), (Marx and Swink, 1963). Population control of other species, such as coyotes for strictly economic reasons, may be a direct influence in preventing rabies epidemics in these species. Along the Mexican Border, where dog rabies is endemic, coyote rabies might already have appeared except for the coyote control programs undertaken to protect livestock interests in the Southwest.

While population regulation as a means of control is based on sound epidemiologic principles, reduction of the reservoir and reduction of the susceptible population, I think we now must accept the fact that the problem is beyond solution by this means with our present resources. While we do not now have a proven means for wholesale vaccination of wildlife populations, vaccination may in the future be the most practical means of control since the reservoir species cannot be eliminated and should not be, even if it were possible. That our knowledge is adequate to control dog rabies has been demonstrated, that our knowledge is inadequate to mount a feasible control program in wildlife is obvious.

Many diseases involve wildlife. Ways of controlling them are important when: (1) they threaten a desirable wild species, (2) they may spread to domestic animals, (3) they may infect man. Control measures may consist of an adaptation of a technique used successfully in other species or for other diseases, or may have to be developed to solve a particular problem. The epidemiologist must have information about the host species including populations, habits, habitat, life histories, and the disease involved, in order to formulate a successful control program.

Workers in other but affected fields are developing a keen interest in diseases of wildlife which also infect domestic animals or man. They look to you for assistance in solving mutual problems, but often are unable to conduct field studies which are necessary to define the epidemiology of a disease in its wild hosts. Their interest, however, is supported by resources not traditionally available to wildlife management. The opportunity for close cooperation is beckoning; and if taken, the opportunities promise reward for all the participants.

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## PREDATORS AND THE LIVESTOCK INDUSTRY

DON CLYDE

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I am glad to be in attendance at this Wildlife Conference. It used to be a considerable distance from Utah to Pittsburgh, but not any more. Modern travel methods have practically annihilated distance. I hope you people don't think of the western states as a wool buyer's small daughter whose father was leaving Boston to purchase some wool in the West. When she said her prayers, her parents were somewhat startled to hear her say, "Please Lord, bless Daddy while he is in that foreign country they call Utah."

I am afraid some of the things I expect to say may shock you people. I hope you will believe me when I say, in all honesty, that nothing will be said that is prompted by malice or unkindness but because of our divergent view points. We are both concerned over those problems under discussion because they affect your recreation, but we who live on the western ranges are fighting for our financial existence.

On March 9, 1964, the Secretary of the Interior Stewart Udall, appointed an Advisory Board which has become known as the Leopold Committee. They have transmitted two sections of their report to the Secretary which have been made public. It seems the Secretary wanted a pro-game report, from the personnel he named on the committee—four professional wildlife people and a college professor. We in the West felt with our large holdings of private lands and our permitted use on other western ranges, we should have been entitled to a prerepresentative on the committee. The National Wool Growers wrote Secretary Udall asking for a committee member, but he declined their request.

One of the recommendations of the Leopold Committee is that a permanent advisory board on wildlife and rodent control be named to advise the Secretary.

We hope representatives from the livestock industry will be recognized on this new committee. We believe the group should be somewhat limited in number and that it should be fairly divided among the opposing groups.

In our opinion, the Leopold Committee worked diligently at the task assigned to them. They gathered a tremendous amount of data covering the entire program, but from a stockman's viewpoint, they were either too prejudiced to consider the western states' problems or they failed to appreciate the tremendous importance of the whole predatory animal program. Their greatest desire, it seemed, was to



turn the 12 western states into a gigantic game preserve. In their obsession to cover the landscape with game, they apparently forgot that there are millions of people in that area and they have to make a living, most of which comes from the soil. With approximately 70 percent of the area in most states federally and state owned, that means only a token payment is made in lieu of taxes. How do they expect us to maintain our economy, educate our children, build and maintain an extensive road system, police the area and pay all the taxes other states have in operating city, county, state and federal governments? We do not have great manufacturing plants or gigantic steel mills to fall back on. If we lose our predatory animal program or if it is drastically curtailed, as the Leopold Committee recommended, we will lose our livestock industry, and President Johnson will have to move his Great Society's poverty program lock, stock and barrel into the Rocky Mountains.

#### RANGE CONDITIONS

Predatory animals kill more than 5 percent of the sheep on western ranges annually. This is a conservative figure that means approximately 30 million dollars completely wasted. The livestockman is concerned with this excessive loss, but believe it or not, he is far more disturbed over the depletion of his range than the dollars and cents angle. The stockman must be a definite range conservationist. Maybe it would lend credence to my story if I admit some of his predecessors were not always as interested in improving the private land or the federal ranges they were permitted to graze on. But competing uses today have rudely awakened him to the fact that he must maintain a sustained yield of grass on his lands, or his forage supply is reduced to a point where he puts himself out of business. The predator is the greatest single obstacle in improving western range lands. Perhaps this is a new thought to you people. Livestock grazing will not cause any material damage to the soil or plant life if the animals can be grazed without too much moving or molestation, but if they must be trailed each night to a camp or corral for protection against predators and the next morning trailed back to the feeding area, the constant movement packs the soil into a hard crust while the plant life is overgrazed because of the constant use. Such a situation places the stockman in the dilemma of either depleting his range or suffering the ravages of predatory animals' continuous kill.

#### FOOD SHORTAGES

Somebody has said that Americans are faced with three problems: Where to park, how to spend their leisure time, and what to do with

their surplus food. The last of these difficulties is rapidly being overcome. Two-third of the world's population today live in diet-deficient areas, and every night many will go to bed hungry. These starving people include all of Asia except Japan and Israel; all of Africa except the southern tip; all of South America except the northern part; and the Caribbean. What is more serious than their lack of food is the fact that they have lost their ability to produce and feed themselves. But the worst is yet to come. In less than 15 years the world population increase will require additional food to feed one billion more people and by the Year 2000, which is only 35 years away, the population will double, and we will have six billion people. The greatest food shortage will be protein, which means largely meat. Congress will soon be relieved of the unsolved problem of "What to do with the farmer," while the agriculturist will be relieved of government subsidies, soil banks and bureaucratic controls. Farmers will be given the green light to apply their technical knowledge to the fullest extent and raise their present ratio of feeding themselves and nearly 30 others to double that amount to save a hungry world that will come begging for food to keep it alive. If the farmers of America from Canada to Mexico are to make this gigantic effort, will not the range operator be required to increase his products and do his part?

In my state there are 52 million acres of land. Less than 4 million acres have available water to grow a crop. That leaves 48 million acres, or approximately 85 percent, which will mature only a growth of range forage. This crop can only be harvested by grazing animals. This year, 1966, marks the start of a new range-improvement program which is being sponsored cooperatively by U. S. Forest Service and the permittees on large areas of U.S. forest lands. The Bureau of Land Management is also making extensive range improvements. The objectives of these activities is to replace the less palatable range plants and bush by reseeding the area to productive grasses.

Stock watering developments are being installed, to replace water scarcity, so all the areas can be properly utilized. Fences are being constructed to keep livestock off precipitous slopes and to improve watersheds where soil erosion is starting. Agronomists tell us it takes 700 years to replace an inch of precious top soil. With this all-out effort to improve ranges to their utmost capacity. I can see little tolerance for predatory animals which nullify these tremendous range improvement efforts.

President Johnson, in a recent message to the Congress, urged that body to authorize immediately a "Food for Freedom" program which would cost 3 billion, 300 million dollars annually. The purpose

of this program, in his words, is "produce more food to keep free men free."

I would like to leave this question with you, please give it some careful consideration. Is it better to feed a hungry child or retain the opportunity to watch a sneaking coyote or a vicious cougar vanish into the forests so that the landscape may retain that primitive look and atmosphere?

In conclusion, may I say that I am here today to offer the western stockman's full cooperation to you and to the Bureau of Sport Fisheries and Wildlife to come to a mutual understanding of our controversies. When honest and sincere men attempt the solution of a seemingly impossible problem, it is marvelous what can be accomplished. I know, as well as I am standing before you, that we, cooperatively, can build a better program to manage wildlife and control predatory animals. I am also just as certain that as long as we continue to condemn each other and cast accusations from a distance, the situation will grow worse, and we will both lose much that we now have.

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## PRINCIPLES OF ANIMAL DAMAGE ECONOMICS AND CONTROL

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Wildlife biologists and others have long recognized that control of damage caused by animal populations is an essential element in a sound program of wildlife management. Any species may, in certain circumstances, cause significant damage to surrounding resources including other wildlife species, or to forest and agricultural crops or livestock, or may endanger public health or safety. Although such inimical activity is often due to an excess population of the species, it also may result from complex problems of ecological competition or interaction.

Control of wildlife damage often, but not invariably, means control of animal numbers. An increasing segment of the general public sees primarily the positive values of wildlife populations and questions the necessity of some control programs, particularly those employing reductional means. A divergent view is held by resource managers and operators of land use industries who are responsible for an efficient total program and are more aware of the necessity of preventing ecological and economic damages. A proper policy of animal damage control must fully recognize these respective points of view, both of which represent authentic social values.

Such a policy based on the premise that all native vertebrate animals have inherent interest and values, but that at times they may require local control, must be readily flexible in application. Its programs should offer a variety of control techniques for counteracting damage situations. Ordinarily this choice would be: (1) exclusion of the depredating species where mechanical protection is feasible; (2) use of repellents, chemicals, electrical, auditory or other sensory barriers; (3) environmental or biological control, including reproduction inhibition of the offending population; (4) reduction by lethal control of individuals or local populations responsible for damage when the other alternatives are not sufficiently effective, economical, or timely to achieve the desired control.

Variations of all these techniques are now used but perhaps without deliberate priority as suggested here. For example, in some areas fencing is the optimum method of controlling damage by resident deer to permanent crops, such as orchards and vineyards. The economics of the long-term effectiveness of deer fencing these high value crops justify the substantial initial cost (Longhurst *et al.*, 1962).

The use of chemical repellents in successfully protecting forest re-seeding operations from rodent attack is well known (Besser and Welch, 1959).

Continuing research promises improvements, such as lasting systemic protection in reforestation (Rediske and Lawrence, 1964).

A lesser known success, perhaps, is the use of broadcast recordings of starling distress calls to prevent agricultural damage, although the method is not new in frightening urban nuisance birds. Amplified continuous-tape calls have given excellent protection to fig orchards and vineyards (Zajanc *et al.*, 1966).

Preliminary studies of the use of chemosterilants in coyote populations are provocative departures from traditional control concepts (Balser, 1964). Research with similar compounds is under way elsewhere to study their effects on rodent populations.

Too often, vertebrate pest control programs are initiated only when an economic crisis arises and are then applied without regard to ecological or biological factors which may materially affect success or failure of the control program. Most attempts to control large-scale meadow mouse irruptions are prime examples of "too little and too late." The population cycle usually runs its course in spite of efforts at reductional control, although some credit may be given here for lessening local damage.

In 1957-58 a super-irruption of *Microtus* was recorded in much of western United States. Crop losses in the Tulelake-Klamath Basins on the Oregon-California border totalled several million dollars

damage to potatoes, barley, alfalfa, and seed clovers, despite massive applications of lethal bait (Spencer, 1958).

Agriculturists in the area have understandably been fearful of a repetition of the disaster cycle so have urged development of improved control methods. A far-sighted and apparently effective program to prevent *Microtus* population irruptions has been tailored to the rodent-cropland-wildland relationship peculiar to the area; it involves new strategy in both rodent control and economics. Briefly, the control principle employed is the treatment of rodent reservoirs on ditch banks, roadsides and wildlands surrounding croplands while infestations are low rather than waiting for rodent population irruptions and their migration and damage to croplands. No major *Microtus* population buildups have climaxed with widespread economic damage since the 1957-58 cyclic peak. Historically in the area, this has occurred in the usual fashion of microtine populations every three or four years. A unique Rodent Pest Abatement District, formed in 1964, now provides adequate advance funds for this preventive treatment (White, 1965).

Examples of vertebrate pest control programs involving population reductions are innumerable. A factor important to them all is the desired degree of reduction. This should be the minimum necessary to reduce the damage to tolerable limits. Lethal control methods should be safe, effective, economic, humane and as selective as possible. To insure truest aim for all these objectives, especially the last one, control programs should be planned and directed by trained personnel.

The term "vertebrate pest" is used here only in a descriptive, not a legal, sense. Unlike some insect, nematode or disease pests, which may be considered generally undesirable, many vertebrate pest situations are created by species which are not categorically undesirable.

Again, deer furnish a classic example. The number one big game animal also creates a number one headache by its adventuresome feeding habits. In addition to causing agricultural and ornamental plant damage, deer are a primary concern in many forest areas. In California, deer damage to conifers is the most serious and widespread animal-caused reforestation problem (Calif. Forest Pest Action Council, 1965).

In Oregon deer annually rebrowse more than 10 million of the 40 million trees which have been laboriously established on 350,000 acres of the Tillamook Burn (Pacific Northwest Forest Pest Action Council).

Birds have barely been mentioned, but they create many damage problems, some of them among the greatest in the world in their

effects on man's productive efforts to adequately feed his swelling numbers. By their mass destruction of grain crops, the various weaverbirds are described by some observers as literally holding the power of life and death for family farmers in some African countries. Here is a spectacular and tragic example of food competition between man and vertebrate pests, with man, so far, the loser.

Fortunately, our bird problems are not directly the balance between human existence and actual starvation, malnutrition or death, but they are the difference between profit and loss for some individual economic ventures. Their impact is felt to a lesser degree in the growing of many agricultural crops, not to mention their importance in nuisance and public health considerations.

In California alone, annual reports of bird depredations show damage by various bird species to more than one-half million acres of agricultural crops.

Within these reports are countless examples of individual losses which are drastic: one 27-acre vineyard losing almost 200 tons of Thompson seedless grapes to starlings; up to one-third of some fields of grain sorghums damaged by blackbirds; at least 15 different crops which suffer reportable damage, 3 to 20 percent, from linnets, a protected species (Calif. Dept. Agric., 1960).

The combined impact on world food production by vertebrate species is to a great extent unknown. Where detailed investigations have been made they have usually disclosed that estimates of damage had been conservative. In some nations agricultural production could be increased more, in less time, by efficient programs of animal control than by improved cultural methods.

The ever-increasing food crisis for the world's millions demands that animal damage control research be advanced. It is hoped that this need can be met.

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## CARNIVORES, SHEEP, AND PUBLIC LANDS

E. RAYMOND HALL

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Mr. Moderator, thank you for your generous introduction.

You might also have added that I am a Kansas farmer, and on my farm raise some livestock.

The title of my talk—Carnivores, Sheep, and Public Lands—suggests that I might speak about the predator control program of the United States Fish and Wildlife Service—about the beginning of that program as a war-time measure in 1915, its growth to the point where it was the biggest peacetime business of the Bureau in which it began, the embarrassment that it has brought to successive Secretaries right down to Secretary Stewart Udall, and the future prospects for this program.

The serious impairment of our natural resources ascribed to this program has been emphasized repeatedly: notably in 1930 by the American Society of Mammalogists; in 1962 in a House Resolution (No. 618 by Congressman Conte) supported by a rapidly growing conservation organization, "Defenders of Wildlife" of which I am a member; in 1964 before this Conference in the Leopold Report by a special Committee appointed by the Secretary of the Interior to advise him; and in 1966 by the present panel-discussion, arranged by The Wildlife Society of which I am a member; and in hearings currently underway in Congress.

Instead of replowing this same ground, I propose to ask a number of questions and offer a few suggestions designed to (1) point up the cause of the present unhappy situation, namely grazing of sheep (not livestock in general) on our public lands, and (2) point out a solution consisting of (a) the exclusion of sheep from public lands and (b) adoption of the state extension specialist system of predator control.

Predator control, as Mr. Clyde has told us, is built around killing coyotes and especially in areas where much of the land is publicly owned, and theoretically where domestic sheep are grazed on our public land.

Should a drunk man beat his mistress with a board or a rubber hose?

Should a man out for personal financial gain graze his sheep on a national forest poisoned with 1080 or on BLM land poisoned with strychnine and fenced at public expense for his use?

There is a widespread feeling that it is best for the married man

not to have a mistress and that it is best for the nation not to graze domestic sheep on our federally owned, public land.

How many sheep are grazed on our federally owned land? The answer is a few more than 7,300,000 of the total of about 26,500,000 in the 48 mainland states.

Who has a share of ownership in our federal public lands? Is it owned by all of us? Is your share the same as mine, and is mine the same as that of the man who grazes his sheep in the Black Hills National Forest of South Dakota? The answer is yes, if the three of us are citizens of the United States.

Most citizens who are unfamiliar with the history of woolgrowers in the western United States are unfamiliar with the devastation wrought there by grazing of sheep. When the devastation is pointed out those persons are surprised that the grazing of sheep is allowed to continue. When those persons learn that carnivorous mammals are eliminated in order to oblige the woolgrowers the surprise changes to amazement. When it is learned that the elimination is achieved at public expense (by expenditure of tax money paid by them, you, and me) they are incredulous.

Few persons know that the woolgrowers pay only 2 to 6½ cents rental per head per month on our public land. That is less than a fifth of what would be paid on private land. Obviously it is much cheaper for the woolgrower to use our public land than it is to own the land.

Some of you have seen enough of the effects of sheep grazing on public lands intended for multiple use to know that vast areas are so seriously impaired by sheep grazing as to render the land unusable for many other purposes.

Opponents of sheep grazing have pointed out that the combined costs in loss of resources is staggering to contemplate. A rough break-down into categories of loss and/or costs (outlay of tax funds) is provided by the following questions:

1. Is desirable vegetation killed?
2. Do undesirable plants appear in unnatural abundance because intensive grazing upsets the ecosystem?
3. Is water runoff hastened?
4. Does soil erosion (sheet and gully) expose bedrock?
5. Are diseases of domestic sheep spread to native mountain sheep?
6. Do ungulates and other game animals disappear?
7. Are carnivorous mammals deliberately destroyed, often by means of poison?
8. Do rodents endure and multiply to unnaturally large populations in the absence of their predators?



9. Do poisons that are spread to kill the rodents adversely affect remaining wildlife?
10. Is timber reproduction impaired by grazing and destruction of ground cover?
11. Do streams collect silt, become polluted, and do fish die as a result?
12. Do dust storms carry off more topsoil than in other areas?
13. Do streams dry up in late spring to the detriment of irrigated crops in lowlands and urban water-needs?
14. Do remedial measures attempted at public expense include brush and weed control?
15. Are seeding and fencing, partly at public expense, now envisioned?

Estimates of losses and costs resulting from the 15 factors just enumerated vary greatly, but all estimates I have seen many times over exceed the net profit realized by the woolgrowers.

Despite this and other special advantages provided for woolgrowers, the number of sheep in the United States is declining year by year.

One of those other special advantages is a generous subsidy on wool. Here is how payments are made:

Assume that an incentive price of 62 cents has been announced and that shorn wool prices actually averaged 50 cents per pound.

The producer would receive an additional 12 cents per pound over his sales return.

But, under the special provisions for wool, the 12 cents is doubled by converting the 12 cents into a percentage of 50 cents as the basis of payments, and so each woolgrower receives 24 percent of his individual sales return from the United States. For example: He sells 1000 lbs. of wool at 50 cents per pound, or \$500 in all. The 24 percent more, \$120, makes \$620.00.

Of the duty collected on raw wool and sent to the U. S. Treasury, 70 percent reimburses the Commodity Credit Corporation that makes payments through the state and county ASCS offices.

The duty, 70 percent of which could go to the U. S. woolgrowers, is collected even on wool sold on unshorn lambs; the duty is collected on the raw wool content of articles containing wool.

Under this arrangement the government does not directly support the price as it does, for example, on corn or wheat, but supports the grower.

The wool subsidy is automatic for four years in advance (or longer if the present agricultural omnibus bill is extended longer). The woolgrowers have the most preferential treatment of any agricultural group in the United States. Up to now the sheepmen have

been able to keep the tariff in effect on imports by cooperating with textile manufacturers.

If the larger woolen manufacturers support the smaller manufacturers and the woolgrowers—if each supports the others—the woolgrowers might be expected to obtain more of what they ask for than otherwise.

The difference in financial capacity and influence as between the woolgrowers on the one hand and the wool manufacturers on the other hand has been likened to the difference in size between a bird shot and a cannon ball.

Since 60 percent of this country's wool needs are met by imports, a difference in objectives could develop as between the U. S. growers and manufacturers. An editorial on February 7, 1966, in the *Washington Post*, notes that a high import duty "hardly advances the cause of the American Consumer and surely alienates our friends in other countries when it seeks to restrict imports of woolen textiles. . . . It would seem that the cause of international amity and domestic price stability would both be served if. . . [we] would stop trying to pull the wool."

However that may be, we produce only 40 percent of our wool needs now. Only about a fourth of our sheep graze on federally owned public land, and for only about a third of a year. That equals less than ten percent of our sheep production. At the rate the number of sheep in the United States has been decreasing over the past few years the number of sheep in the United States could be down that much in three years anyhow. Consequently removal of sheep from federally owned public land would be of little, if any, over-all direct significance in reducing the number of sheep over a period of three or four years. Indeed, excluding sheep from our public land would remove a serious competitive handicap for the sheep raisers of the middlewestern and eastern states and might very well increase the over-all number of sheep raised in the United States.

In any event, the exclusion of sheep from our federal public lands would remove the principal excuse for federal predatory mammal control.

Recent changes in administrative personnel in the U. S. Department of the Interior and in the Bureau of Sport Fisheries and Wildlife have been accompanied by promises of reform in policy and practice of predatory mammal control. But, the chances of actual reform, especially in practice, through the Executive Branch of the Federal Government alone are slight, indeed. This was demonstrated in 1930 following the hearings in Congress where the American Society of Mammalogists reported its findings and recommended a better

and less expensive program of control. The Congress held up the appropriations for predatory mammal control and also for all legitimate work, as well, of the entire Bureau of Biological Survey, of which the Predatory Mammal Control Division was a part.

Instructions were issued to personnel to develop a changed attitude, and the critics of the old system of control were implored by the federal biologists to "say we don't want the whole bureau destroyed." The critics responded positively. Improvement in methods of control were promised by the Bureau, then its appropriations were made, the number of employees was reduced, the chief of the Bureau lost his mind and health, the head of the Predatory Mammal Division was replaced, and a new start was made.

Thereafter, the woolgrowers lobbied for continuance and expansion of the old system, appropriations for it were gradually increased, the program grew up again beyond the bounds of any demonstrable need, newer and even more indiscriminate methods of mass control were devised and used, and, as was brought out at the hearings in Congress on February 2, 1966, the size of the force of federally directed coyote hunters has grown up again to even larger proportions than before; 730 of them, not counting their supervisors and administrators, now are at work except for the considerable proportion of their time spent on public relations in order to create a demand for their services.

The Wildlife Society and the Wildlife Management Institute are to be congratulated for arranging this Panel Discussion that brings into the open an abuse and mismanagement of a national resource that has the earmarks of a biological disgrace and a national scandal.

In order to phase out the antiquated federal system of predatory mammal control, both the Congress and the Executive Branch of the Federal Government probably will have to combine their strength and power.

Although the attitude at the three or four highest levels of administration in the Department of the Interior is enlightened and therefore offers opportunity for needed change in policy, the 700 to 900 employees in the field are not about to change.

They know that the average tenure is short for the makers of policy; many of the 700 have served under more than one director, assistant secretary, and secretary and aim to serve under several more.

Members of this Conference may recollect that the Bureau now saddled with the predatory mammal control organization has abolished, in past years, entire divisions when they no longer were essential on the national level. Examples are the Food Habits Division and the Division of Fur Resources. Unfinished segments of those un-

dertakings were attended to, where necessary, by state agencies. Adequate precedent, therefore, exists for doing the same thing with the predatory mammal control operation, especially since Missouri and Kansas have demonstrated that such work as may be needed along that line can be done at a twentieth of the cost, and more effectively as well, by state than by federal government.

The fear on the part of the 730 federal poisoners that reform will leave them without jobs is understandable; but, that fear is unrealistic because they are needed in constructive work carried on by the same bureau. For instance, they are needed in refuge management and are needed to fill the new positions to be requested for persons who can appraise the effects of pesticides and herbicides.

I am very much in earnest in recommending this transfer of personnel: First, because of the great need to appraise the effects of pesticides; second, because I would like to see every one of those coyote poisoners doing something else—something constructive instead of destructive; third, because trained persons these days are in short supply; and fourth, because I, a taxpayer, would be as greatly pleased, as members of the federal Budget Bureau might be, at staffing the new enterprise without providing additional funds to do so.

The constructive approach to predatory mammal control is to substitute the State Extension Specialist System for the Federal System.

The plan for doing that, outlined in House of Representatives Bills Nos. 4159, 7433, 7464, 7744 by Mr. Dingell, Mr. Saylor, Mr. Conte, and Mrs. Griffiths, respectively, is a reasonable and conservative approach. Instead of abolishing the Federal Predatory Mammal Division at one fell swoop, and thereby removing the almost insurmountable obstacles to establishment, without delay, of the State Extension Specialist System, the bills provide instead for gradually phasing out the unwanted system while making the transfer to the wanted system that takes advantage of the recent findings in animal ecology and the scientific findings in mammalogy.

The State Extension Specialist System of Predator Control has been in effective operation in Missouri for 21 years and in Kansas for 17. In Missouri the specialist is attached to the Conservation Department, and in Kansas to the Agricultural College. One attachment has worked as well as the other. Missouri is Democratic, Kansas is Republican, and the specialist system seems to work as well for one political party as for the other.

It works equally well all the way from the smallest farms of the timbered areas of eastern Missouri to the huge ranches of 35,000 or more acres on the treeless short-grass plains of western Kansas.

The statutory provision is simple. In Kansas it amounts to a requirement that when any money has to be spent for the control of coyotes, other predators, rodents, or birds the county commissioners "shall request the services of" the expert to survey the needs and recommend measures. Furthermore, the college is authorized and directed to supply upon request information on control and to make available the services of the specialist to demonstrate methods (see G.S. 1949, 19-2317 and 2318).

In practice it works this way: When an individual or company has troubles that seem insoluble, appeal is made to the county agricultural extension agent, who calls the specialist. He advises, demonstrates where necessary, and often removes the individual causing the damage in the course of the demonstration.

The rancher feels that he or his employee now has the expert knowledge to solve his problem and does so.

In each of the two states the total cost in taxpayers' money is less than \$17,000 per year—less than one-twentieth of the cost of the federal predator control cooperative system, for example, in the adjoining state of Oklahoma.

Details are well explained in "Common Sense in Predator Control" by W. O. Nagel, *Defenders of Wildlife News*, Vol. 40, No. 5, pp. 21-24, for December 1965. Additional details are given in the following: "Controlling Coyote and Fox on the Farm" by F. W. Sampson and W. O. Nagle, *Missouri Conservation Commission*, pp. 1-20, illustrated, 1951; "Missouri's Program of Extension Predator Control" by F. W. Sampson and A. Brohn, *Jour. Wildlife Management*, 19:272-280, 1955; "Predator Control Why and How" by W. O. Nagel, F. W. Sampson, and A. Brohn, *Missouri Conservation Commission*, pp. 1-32, 1955.

As between states, this system, of course, would yield unequal results (we have them now under the federal system). But the results would be much more nearly equated with need than is now the case. Economy, efficiency, and the national interest clearly would be served by this system.

In conclusion, members of this Conference are urged to work for the elimination of domestic sheep from our publicly owned lands, and the substitution of the state extension specialist system of predatory mammal control in place of the existing federal system.

## THE NEW LOOK IN ANIMAL CONTROL

JACK H. BERRYMAN<sup>1</sup>

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I sincerely appreciate the opportunity to discuss the animal control program of the Bureau of Sport Fisheries and Wildlife, conducted by the Division of Wildlife Services. It is essential that those of us professionally involved in wildlife management work to develop a clear public understanding of what we are doing, what we intend to do and why in the field of animal control. This nation's citizenry is awakening to the values and esthetics of our natural beauty. This is long overdue and most encouraging. We must also, however, develop a favorable climate for control, when and where needed to safeguard other interests of man.

Animal control and especially "predator control" is one of the most, if not the most, controversial issues on the resource management scene today. This is to be expected. We are dealing with an extremely emotional matter—the killing of wild animals, creatures that are dear to the hearts of a great mass of the citizenry. They find this repugnant and distasteful. No matter what the technique or method, nor how "humane," the end result is the same. The animal is dead.

On the other side of the coin are hazards to human health and safety; economic losses to agriculture and other segments of industry; damage to expensive man-made structures; and contra-esthetics—plain filth.

Is it any wonder then, when we deal with emotions, man's pocket book and health and safety factors, that we engender controversy? Then, there is the specter of change—change in itself generates apprehension, misgivings, and controversy, especially when you begin to reorient a cooperatively based program that has been firmly established for over fifty years.

Suffice it to say, and you can take my word for it, there *is* controversy, and we expect it to continue and perhaps intensify for a few more years until we "prove up" on stated intent.

With this as an introduction, let me briefly review some of the major events of the past two years and then go on to state a control philosophy and describe the elements of our new program.

Just two years ago at this same Conference, held in Las Vegas, Dr. A. Starker Leopold presented the report of Secretary of the Interior Stewart L. Udall's Advisory Board on Wildlife Management—the so-called "Leopold Report" on Predator and Rodent Control in the

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United States. Many of you were present. Others have carefully studied this historic document since its release.

The Board recommended the appointment of an advisory board on predator and rodent control; a reassessment by the Bureau of the goals of its predator and rodent control activity; the development of rigid criteria for determining when and where there is a need for conducting animal control; a greatly amplified research program; a new name for the predator and rodent control arm of the Bureau; and, legal controls over the use of poisons. It generally recommended a complete reassessment of the goals, policies and field operations of the Division of Predator and Rodent Control, with a view to limiting the reductional activities strictly to cases of proven need, as determined by rigidly prescribed criteria.

As most of you know, Secretary Udall accepted the Leopold Report on June 22, 1965 as a "general guidepost for Department policy . . ." In effect, the Board crystallized thoughts that had become current, and its report became the instrument for needed change. Many assume the Report is the working manual for the Bureau. This is not the case. It is a useful and important guide. Perhaps its most important contribution is not the specific recommendations but its reflection of a changing American attitude—a shift in the public conscience.

Secretary Udall's acceptance of the report is well known and need not be repeated in detail here. In essence, he pointed out that, while the Department did not intend to abandon its animal control responsibilities, new guidelines would be developed to assure that control would be conducted when and where necessary, using the most selective, efficient and economical methods, based on sound ecological principles and that the Department was concerned with the wise husbandry of all wildlife resources.

It is within the framework of this broad policy statement that we are now working—it is this broad policy that we have begun to implement.

The recommendation of the Leopold Committee for a new name for the Division of Predator and Rodent Control was effected on July 1, 1965, with establishment of a new Division of Wildlife Services. This was far more than a simple change in name. It was the establishment of a new division, with added responsibilities, intended to improve conditions for other wildlife resources. On August 1, the working titles of all division personnel were changed, coincidental with the effective date of the reorganization plan for the entire Bureau. As now constituted, the new Division will have responsibility for the animal control activities of the Bureau but will have added

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responsibilities in wildlife resource enhancement work and pesticide surveillance and monitoring.

In enhancement work, emphasis will be given to migratory species, both game and non-game, with initial effort on Indian, military, and Interior lands. This program will not duplicate or compete with existing programs. The needs are so great that the challenge is one of determining where to channel the effort to realize maximum results.

The pesticide surveillance and monitoring program is being designed to prevent adverse effects of pesticide applications on wildlife and the total environment. Initial surveillance efforts will be on Interior and other federal lands. The monitoring phase will contribute to the National Monitoring Program to determine residue levels at fixed locations and at predetermined intervals. This began last December, when the first sample of duck wings were taken from collections being made in each flyway for other purposes.

The most important development in animal control has been the preparation of a completely new policy, now in the review stage. Before commenting further on this policy or its implementation, let me discuss the morality, ethics, or the "ecological conscience," if you please, of animal control.

We view animal control, or more properly, animal management, as one of many necessary and legitimate resource management tools—not unlike habitat improvement, stream and lake treatment to remove the so-called trash fish and replace them with sporting varieties, range restoration, reforestation, harvest and a host of others. Hunting, or harvest of big game, quite often is simply an acceptable form of animal control. Like all management tools, animal control must be applied intelligently and responsibly, or it merits just criticism.

Let me turn for a moment to the "balance of nature," that holy cow that continues to haunt modern-day, professional resource managers. At the risk of being sacrilegious, I submit that scientists who continue to babble about the balance of nature, without qualifying that concept considerably, do the public a great disservice and retard sound resource management.

I think and hope we all recognize ecological relationships—this is what we are really talking about. But, let me remind you that, according to Webster, ecology is defined as ". . . the mutual relations between organisms and their environment . . ." And, it has always been my understanding that this meant the total environment—an environment drastically modified by man since early colonization; yes, even before the arrival of the white man. Sociological



change has made a new and increasingly drastic imprint on traditional ecological relationships.

The plain fact is that we now live in a synthetic environment, modified by the most complex civilization in the history of man—megapolis, roads, intensive farming, pesticides, livestock grazing, pollution, atomic testing. You name it. It follows logically that we must manage resources within the framework of this synthetic environment, responsive to sensitive ecological relationships, and receptive to the obvious needs of an expanding human population.

It then becomes incumbent on all resource managers, planners, industry, agriculture and the public generally to avoid to the extent possible, further adverse impact upon our resource base and the environment generally. This is the attitude we intend to assume.

Now let us be more specific. The activities of man have adversely affected some wildlife species, including some kinds of game species. These same activities, however, have improved conditions for other species and even changed their behavioral patterns to the point where they are now overabundant and in situations where they pose serious problems.

Blackbirds and starlings are good examples. Last year 15 State Farm Bureau Conventions passed resolutions urging assistance with bird problems. In Ohio some counties have had to quit growing sweet corn.

Likewise, conditions for some birds, including starlings and gulls, have been improved in the vicinity of airports, both military and civilian, posing real threats to human safety. The number of air strikes is continually increasing, and, as you know, there have been two civilian aircraft strikes that cost over one hundred lives.

Plague and rabies pose lingering and potential threats—both animal-borne diseases—not to mention histoplasmosis, a pulmonary disease associated with starling roosts and some other birds. Last summer there was one human death and over a dozen human exposures from plague near Gallup, New Mexico. And the highest known incidence of rabies in an urban bat population was recorded last summer in a major eastern city.

The moment man began grazing livestock he quite naturally came into competition with the larger carnivores that, by their very nature, prey on ungulates.

Grazing had still another impact—generally, any grazing improves the conditions for some rodents, such as the gopher; and overgrazing frequently provides an ideal situation for some rodents that then become, under some circumstances, a further threat to the range.

Let me pause at this point to make a comment on range ecology

and management. It is pointed out by some that past range abuse has resulted in increased rodent numbers, and, because of this, we should not control the rodents which are a symptom, but correct the cause—namely, overgrazing—and let the rodent situation take care of itself.

The advocates of such an approach are living in the past. Yes, there have most certainly been serious range abuses. But there is general progress, though it may be slower than many of us would hope for. If rodent control is a part of a planned range restoration program and will hasten a healthy range condition, is it not more prudent to employ a control tool than to take the attitude of "you did it, you clean it up"? Healthy ranges and watersheds are in the best interests of the general public.

Also, within this synthetic environment in which we live, there persists the perennial argument: Do predators control prey numbers or do prey numbers regulate predator numbers? The bulk of the scientific evidence suggests that the latter is true; that the breeding potential of the prey species is greater than that of the predators who respond to an increase in numbers but do not provide effective control. But speculation, based on would-be scientific logic, runs rampant—stated as fact by scientist and layman alike. But where are the facts? The simple truth is that we do not yet clearly understand these relationships. We need more research and less speculation.

So we live in a synthetic environment and it frequently becomes necessary to control animals for various reasons. Let me be clear on this point: So long as Congress appropriates funds to this Bureau, and directs that we do so, we intend to control animals when and where necessary in the most intelligent and responsible manner possible, using the best tools, with the most efficacy, and with full recognition of the ecological interrelationships.

Speaking of tools and techniques, we must use the best available, and this is what we are doing. Some compounds and techniques we would like to see replaced, and we are working on this. But, until we have better techniques, we will do our best with what we have.

Now, let me state also very clearly the other side of the story: This Bureau will conduct or participate in animal control activities in situations only where there is a clearly demonstrated need, in situations where there will not be significant adverse effects on non-target species and the environment generally. Several hard decisions have already demonstrated the Bureau's determined intent to hold the line.

Now, how do we propose to effect the necessary changes to meet

our control responsibilities intelligently and at the same time avoid damage to non-target species and the environment generally?

For too long those concerned with animal control have focused on the offending species and this has seemed logical. There has been entirely too little attention to the combination of circumstances—again, the ecological situation—that has created favorable conditions for the problem animal. It is the total ecological situation, not a single species, that results in a pest situation—usually the results of man's activities.

Ironically, the attention to the animal itself and our efforts at simple reduction have often been little more than a good management program acting to manage or maintain the so-called pest at an optimum level.

It is time we re-examine man's activities in relation to the environment to determine whether the application of ecological principles would not, in the long run, prove more economic and more desirable. We have become too "single purposed" in our management objectives; and, I apply this generality equally to agriculture, forestry, wildlife management in general, and animal control in particular. While direct control of the offending animal will probably be a necessary expediency, the challenge is in making the necessary ecological adjustments to prevent pest situations.

Now, let me turn to a few statements on policy. Animal control will be conducted to assist in accomplishing four major program goals:

(1) *Public health and safety*, when it is necessary to control animal-borne diseases, such as plague and rabies and to prevent safety hazards, including aircraft-striking birds.

(2) *Improving agricultural production*, including the protection of livestock and standing and stored crops.

(3) *Resource management services*, including necessary bird and rodent control to insure the success of range restoration, reforestation and watershed projects and wildlife management where control is essential to wildlife introductions, or undertakings to increase wildlife numbers.

(4) *Urban and industrial services*, when control is necessary to protect buildings and residential areas, stored manufactured products, and underground conduits and similar installations.

These four goals can be pursued either directly, on an operational basis, when the proper methods can be applied only by skilled professionals, or through a program of technical assistance to land users and commercial operators to assist such people in conducting their own control programs.

In our search for improved techniques, continued field testing will, of course, be an important part of all four goals.

I want to stress one point of the new policy as it relates to the four program objectives—we intend to place increasing reliance on the land and resource managing agencies; on public health officials; on industry and agriculture; and on their responsible officials and elected representatives in determining when and where there is a demonstrated need for control.

It is quite obvious that such is not the sole responsibility of this Bureau. Control is a management tool, to be applied when needed to accomplish a broader management objective and, if needed, it should be included in the plans prepared to accomplish that objective.

How lands will be used and managed is a responsibility of the land and resource management agencies. If these managers identify a use that requires a degree of animal control to achieve a planned objective, appropriate control techniques will be applied by the Bureau. By making control available only when the need for control is included in the resource management plan of the appropriate agency, we hope to encourage preparation of long-range resource management plans.

The Bureau clearly recognizes a need for new and more sophisticated techniques, and we are intensifying our efforts to develop these through research. We should be able to improve our efforts and at the same time make these more selective. We cannot expect, however, that research results will be accomplished by tomorrow or next month.

We intend to determine, through independent sources, annual data on losses, damage, and disease on a national scale. The United States Department of Agriculture has agreed to assist in this effort.

Before the Bureau's new policy is finally adopted, we shall consult with the user groups, other cooperators, major conservation organizations, resource management agencies, public health officials and others.

One thing that has been extremely difficult is to develop guidelines for determining a demonstrated need. It is a matter of real concern to those of us charged with the responsibility of determining that need. We think, however, that we have found the answer and that we can do this on a sound basis.

We are adopting a management system of planning, programming, and budgeting. In this process, planning, programming, budgeting and reporting are all associated and tied directly to end objectives and criteria for action. Through this system it will be possible to determine whether there is a demonstrated need for animal control—

and the Bureau, cooperators, and interested bystanders can see where we are going and why.

An annual plan of work will be developed for each state. This plan will rely heavily on land planning and zoning, and the management plans of other federal, state, and local resource agencies. On Federal lands, it will be tied to the multiple-use concept now being applied by the Forest Service and the Bureau of Land Management. It will identify specific program objectives. The plan will not be an animal control plan, but a series of goals which require animal control, among other actions, to achieve success.

If a given tract is identified by the managing agency or the owner for grazing purposes, animal control becomes one of the management tools. By the same token, if an area is identified by the managing agency as a primitive or wilderness area, and grazing is not one of the planned uses of these areas, it will be clear that there is no demonstrated need, and control will not be practiced; however, peripheral control might be needed around the exterior boundaries to prevent these areas from serving as reservoirs of predation.

If the Bureau of Land Management or the Forest Service intends to initiate range restoration or reforestation on a given acreage, rodent control would be one of the necessary management tools to accomplish this undertaking successfully. Here again, there is clearly a demonstrated need and a specific objective that can be spelled out in terms of a resource plan and the number of acres involved.

This concept can be applied in virtually every situation, and ultimately result in a complete state plan. When the plan is completed, in consultation with cooperators, landowners, and agencies, it will be translated into a program and provide a realistic basis for preparing budget estimates. It will also serve as the basis for identifying manpower needs and selecting alternatives. Monthly and annual reports will then cover progress, or lack of progress, on each of the identified objectives.

Thus, for each state in the nation, and consolidated for each of the Bureau's regions, we will have a clear-cut course of action that will aid us in supervising more intelligently a basic resource program for the benefit of the many publics which we serve.

Improved manpower utilization is essential to more effectively meet our responsibilities in the most economical and most responsible manner possible. For this we need flexibility, improved supervision, increasing use of the advances in modern technology, and an aggressive training program.

Training is fundamental. To some it may seem a luxury or icing on the cake. In our view, it is a matter of the highest priority and

will precede changes in our operations. We must maintain a staff of highly skilled professionals, able to move swiftly and using the latest techniques, in harmony with other uses of the land and other public values.

Applying new technologic advances will be extremely important in pursuing a more efficient, yet more selective program. The Bureau continues to increase its efforts to find improved methods of control through research and field testing, working with cooperators.

The concept of integrated control is gaining acceptance in insect control work. We intend to apply this concept to vertebrate animal control. First, we must examine the specific problem to determine if there are alternatives to direct control. If not, we must then determine what combination of methods, taking advantage of the ecological situation, that will achieve the desired results with minimum side effects. Ideally, this would permit us flexibility in focusing several appropriate techniques to secure an acceptable level of control. Integrated control would also broaden the control base and take cognizance of the dynamic forces which are continually changing.

I could not close this discussion without commenting on personnel, specifically those in the Division of Wildlife Services. Our people look forward to the challenges of the future. They are confident and willing. We now have the most important ingredient for success—willing and highly trained personnel. A high percentage of the Bureau people in the Division have degrees in resource management.

We are in the process of attempting to create a climate that will stimulate individual and collective excellence and a high degree of professionalism. We propose, by providing the challenge and through training, continuing education, persuasion and encouragement, to develop to the fullest extent possible, the full capabilities of every man in the Division.

We then propose to bring this capability and talent to bear in discharging an intelligent and responsible animal control program and move into pesticide surveillance and wildlife enhancement work.

This is our "new look." Thank you.

#### PANEL DISCUSSION

MODERATOR LAWRENCE: From the divergent views presented by the panel, I can see we have a big pot to stir.

I think that perhaps one of the most significant points brought out in this discussion is to determine whether we will or will not undertake a control program. This is where we need facts and not emotional stands or extreme stands. They only delay and cloud the issue.

Being interested in the impact of forest wildlife or forest regeneration, this has been a subject quite dear to me. I would like to propose at this time that we introduce into our literature a new term—"economic carrying capacity of lands," at least insofar as resident game species are concerned, this being the level at

which animal population can be maintained without serious economic losses. This may be different from the biological carrying capacity and, like the biological carrying capacity, it will change. We may have a big difference at the early stages in the formation of a forest between economic carrying capacity and biological carrying capacity. However, as time progresses, they might converge and become one and the same.

Now, as the moderator of this discussion, I would first like to establish a ground rule. We are not going to discuss the economics of the wool industry and we will address ourselves strictly to wildlife matters.

I now turn the matter over to the audience for any discussion in relation to any of these papers.

MR. ALPHA MUNCIE (Nebraska): I would like first to say that in Nebraska we agreed with the statement made that control be done where necessary and, further, that an eventual plan should be made for each state. However, I have one question I would like to address to Mr. Clyde.

Have you ever experienced any good or benefit from the coyote?

MRS. CLYDE: I am thinking real hard as I get up to answer that, and I would have to say "No."

MR. MUNCIE: I would certainly have to differ with you and I am willing, as sure as I am standing here, to say that in the very near future the coyote and especially those in Nebraska (and I realize that everybody has their problem) will be counted as a game animal and not as a predator.

If I may, I would like to state that through the sheep ranchers and other ranches in our state, a law was recently passed by our Legislature. We have had federal people attempting to carry out a control program in our state. It is over-controlled. We right now have an organization of ranchers that will appear before our next session of the Legislature. This law will be repealed. We will take care of our own. We believe in a good control program and, as I said before, we will do it when and where necessary. Further, there should be a complete program for each locality or state.

Now then, here is exactly what happened in our state. In our Sandhill Country, we have very thin cover. When coyote control was done we had nothing but pocket gophers. We have found that their damage must be repaired and immediately and at great cost. I am sure you all understand what I mean. At any rate, this has been our experience.

MR. CHARLES CALLISON (National Audubon Society): I have a question that I would like to direct to Mr. Berryman.

Jack, you said that in the administration of the animal control program under the new policy that was being developed by the Bureau that you will place increasing reliance upon other resource management agencies. You mentioned, I think specifically, the Forest Service and the Bureau of Land Management. You indicated, if I understood you correctly, that you would more or less depend on requests or advice of these agencies as to when and where animal control is necessary and, on this basis, you would work out your plans. It sounds to me, Jack, as if this is going to be done on a consulting basis and passing of the responsibility from the Bureau Sport Fisheries and Wildlife to the Bureau of Land Management, to determine when there is a demonstrated need.

I wonder if you would comment further on that because it did worry me a little. This is especially true since I heard you testify not too long ago before the House Committee, at which time you made the same statement. In other words, it worries me that your policy is going to develop into a relinquishing of the responsibility of determining when and why there is a demonstrated need for animal control.

MR. BERRYMAN: I think your question is well put, and I think it is really a rather difficult and long-winded thing to explain.

Let me first say that we do not intend to abdicate our responsibility for the final word on when there is a demonstrated need. However, while there has been a very close cooperation with the Forest Service and the BLM, public health

officials and others, I don't think we have worked closely enough with them and so there has been a real question in connection with trying to figure out how or when to identify social values.

You will also recall that the Leopold Report mentioned the thrill of hearing a coyote chorus in the night. I think we all appreciate that and understand it, but, on the other hand, when you try to translate that into management you run into trouble. Therefore, after a lot of consideration and discussion with other people as to the simplest solution, we feel that, if we were to tell the Forest Service that this tract is more important for grazing and this other one is more important for recreation, I am quite sure there would be some repercussions. The same thing applies to the BLM. Therefore, I think that we have to consider zoning and use that as a basis. In other words, it will be their responsibility to determine whether a piece of land is to be used for grazing, for a stock grazing, requiring a control plan, and so on.

However, we do not intend to pass the buck. We intend to place responsibility for determining land use and then what types of land use require control. Further, we will determine the techniques for that control, reserve the right after examination to indicate that we do not feel in our judgment that it is necessary. In other words, in the final analysis, we are the ones who will have to answer for it.

Also, in the past we have talked about pigeons and starlings in the city and have urged that some controls be undertaken. However, I don't believe that is our business. When the city fathers and health officials decide that pigeons or starlings have sufficiently defaced the downtown buildings and pose a threat to health, then we know how to get rid of them. Upon their request and under their supervision, we can then engage in control work there.

The same is true in connection with rabies. Here we must work closely with the Public Health Service in identifying at what point it is necessary to attempt to reduce the numbers of the vector and at what point we may be reaching success.

In short, we do not believe that we should promote, conduct, evaluate and defend animal control work, but we do have the final responsibility for it. Have I answered your question?

MR. CALLISON: Yes, thank you very much. Now if I may, I would also like to put a question to Mr. Hall. Are any figures available to indicate that in Kansas, where the extension specialist system is in effect for animal control, specifically to control coyotes, if there is any substantial difference between the reported losses by sheep ranchers as compared to those recited by Mr. Clyde?

MR. HALL: Yes, there is a difference. I do not have all the figures, but I know something about the figures in my own state and in adjoining states, and I can best answer it with an example.

When our extension specialist not too long ago was asked to come and show people how to control coyotes that were killing calves, he first asked a veterinarian to make a survey for him of animal diseases that may have been involved. In other words, were the calves dying of certain animal diseases or were they really dying as a result of coyote activity?

He found some eleven calves that had died of various types of disease. So here is a simple illustration as to how coyotes might have been blamed for something they were not responsible for.

Now, in our state, losses attributed to coyotes, we believe, are greatly exaggerated, because it has been proven that many of these animal death are due to other causes.

MR. CALEB GLAZENER (Texas): As a private citizen whose origin and whose principal experience is in a state under almost complete private ownership and in which there is a considerable number of sheep—it is my thought that our private operators stand to improve their philosophy of land use and management of wildlife. I can see little point in extensive and intensive predator control when harvest of deer is far short of what is needed. In other words, there is no point in protecting a species which, in excess numbers, helps to denude the privately owned lands. This then, in turn, contributes to this other picture,



the need for erosion control and soil pollution of our streams. I merely make that as a comment and I hope you gentlemen understand it.

DR. CLARENCE COTTAM [Texas]: I just wanted to state that from my past experience in the Service there isn't the slightest question in my mind that the proposal that Mr. Berryman has offered of placing some responsibility on the management agency, such as the Forest Service, or Bureau of Land Management, will cut down on the over-all amount of control asked for. I have seen this work in many cases, particularly when we were working in connection with the so-called Leopold Report and getting the facts for that report. For example, an overzealous control operator can drum up trade, and a lot of it has been nothing more than that. This will be a means of helping to avoid the doubling up of trade. I think there is much merit in having the agencies, for example the Forest Service, handle their own affairs as much as they can and, when they need expert help, to then call on the competent agency. In other words, they can then possibly call on the Fish and Wildlife Service and other agencies. After all, the Service people do have some property which contain forests and, therefore, we need expert help in the field of forestry. As a result, the Forest Service might be called upon. It doesn't seem to me that this is any different from the Forest Service calling on the Fish and Wildlife Service when they need some expert help in control.

I am very much in favor of control where there is a genuine and proven public need. There have been too many cases where the control has proceeded because of the overzealousness of the operators.

MR. LAWRENCE: Mr. Clyde has asked that he be permitted to answer some of the questions that Dr. Hall has raised and, therefore, unless there is further comment from the floor, I will now call upon Mr. Clyde.

MR. CLYDE: This is not by any means an attack on Mr. Hall. I admire a man that has the courage of his convictions.

I would like to say, on the other hand, that he has greatly misinformed you when he talks about the public paying for this control. In Utah, we pay 65 percent of the control program. This leaves 35 percent that comes out of the federal budget, and I think we go a lot further than that in personal contributions.

Another thing that Dr. Hall made quite a point on was this subsidy in connection with wool. I don't remember exactly when Harry Truman was President, but I think it was just in the late fifties. However, he reduced the tariff on wool 33-1/3%—just cut it right off. We could not live with that. I was in the group that sat down with President Eisenhower and told him we needed some help or we could not stay in business. We had recommended a tariff raise and the Tariff Commission had agreed with us. However, President Eisenhower said that we could not be given any tariff help, that we were in a world in which we had to keep a balance between these countries and, therefore, the tariff could not be raised. However, he said, on the other hand, that we get together with the Department of Agriculture and work out some kind of plan to help the wool growers so that they could live and something which would not raise the tariff. Therefore, this is how this subsidy came about.

Now, as Dr. Hall indicated, this subsidy is taken out of imports. It does not come out of the Treasury. It might come from imports and go into the Treasury and come right out again but, on the other hand, it isn't a new tax on the American people because the foreigners are paying it on the wool they ship to this country.

There is also one more thing that I would like to say and that is that this problem developed because of the bigness of this country of ours. It is just a different situation out where I live. You talk about these cheap lands and the BLM. Well, I wish I had never heard of the BLM permit. I would have been better off financially if I had given them back and said, "No, thank you, I don't want it." However, I cannot go into that now. The West had to be settled. They have set up ways to dispose of that land under the Homestead Act. In other words, they go out and take so much of that ground and do so

much work. When the Union Pacific went out there with the railroad the Federal Government could not build it and so they gave them every opposite section on each side of the track to get a railroad. All of these things contributed to the building of the West. Further, it is an arid country and that is the reason that we were able to build it up and, because of this, we have used different methods and it is not a give-me program.

MR. LAWRENCE: Thank you very much. Now then, Mr. Hall has asked for two minutes and with his rebuttal we will close our short course on wool growing. (Laughter)

MR. HALL: Mr. Clyde is quite correct in stating the percentage of funds supplied by local agencies, wool growers, counties, etc. In speaking about this tax money, on the other hand, he is speaking about your money and my money. However, I was speaking about the \$2 million appropriated from the federal funds for this purpose and not about the total of \$5.5 million which is devoted to this purpose. The other \$3.5 million comes from contributions such as were indicated.

Now then, in relation to this matter of pushing this program which was previously alluded to by Mr. Berryman.

This still continued as late as January 22nd, when Mr. Crawford of his Division came to our state and pleaded for permission to undertake control in our state at no expense whatever to the state.

CHAIRMAN WOODWORTH: I see that our time is now up. In closing this session I wish to thank the panelists and the men who gave the earlier papers and also those of you in the audience for your comments and for your excellent attention.

The session is now adjourned.

# TECHNICAL SESSION

Tuesday Morning—March 15

*Chairman:* FRED W. STANBERRY  
Director, Tennessee Game and Fish Commission, Nashville

*Discussion Leader:* BILL T. CRAWFORD  
Game Unit Leader, Missouri Department of Conservation,  
Columbia

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## FIELD AND FARM RESOURCES

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### UTILITY LINE RIGHT-OF-WAY MANAGEMENT

DALE H. ARNER  
*Mississippi State University, State College*

Utility line right-of-way development for wildlife has been the subject of numerous papers. Techniques involving bulldozing, disk-ing, selective basal spraying, mowing, fertilizing, seeding, and pre-scribed burning have all been experimented with, and their value has been acclaimed in the dual role of producing supplemental game food and retarding the invasion of unwanted brush. Wildlife ecologists writing about their particular technique invariably point out the millions of acres of rights of way available for multiple land use. However, a survey of state conservation agencies in ten southeastern states revealed that only one state appears to have made substantial gains in right-of-way management for wildlife. Four states reported no cooperative work or research work underway, and five other states reported some cooperative work with the total acreage involved for these five states under 3000 acres. This amount is ridiculously small when it is known that one of the southern states which reported no cooperative work underway has well over one quarter million acres of land in rights of way.

The purpose of this paper is to present the results of cooperative planning in dual right of way maintenance work in three southern

states in the hope that our successes and failures might serve as a guide for future cooperative work in other states.

The first cooperative right-of-way venture this writer was concerned with was inaugurated in Maryland in 1948 by Ernest A. Vaughn, then director of the Maryland Game and Inland Fish Commission. This cooperative research between the Potomac Edison Power Company and the Maryland Game Department was initiated under a memorandum of understanding whereby the Potomac Edison Company would pay for preparing the ground by bulldozing, and the game commission would seed the area. Seven years after the establishment of a grass legume sod, it was found that only about 20 percent of the nine miles of sodded right of way needed renovation (Arner, 1960). The renovation consisted of reworking the ground with a spring shank cultivator, fertilizing, and reseeding it, all for the cost of \$29.00 per acre. The total cost for the 127 acres of right of way for the seven-year period was less than \$7.50 per acre per year, with the game commission's share being about \$1.50 per acre per year and the power company's share being about \$6.00 per acre per year. The Potomac Edison Company furnished cost information on the use of herbicides in controlling woody vegetation which indicated that this same area would have cost the power company nearly \$14.00 per acre per year for chemical control of vegetation. The reduction of maintenance costs was so evident that the Potomac Edison Company offered to work cooperatively in other areas of the state. In planning for cooperative work in other areas, it was found that a simple memorandum of understanding, which was not much more legally binding than a gentleman's agreement, was the only feasible way of obtaining a workable agreement between the power company and the game commission. A more formal legal agreement was attempted, but such an impossible entanglement of legal concepts was brought out and argued by the lawyers of the company and the state that this attempt was abandoned, and future planning was based on a simple memorandum of understanding.

The opportunity to work with private landowners and utility companies in Alabama came about when I began work with the Soil Conservation Service as a biologist in 1957. No such cooperative work was underway in the State of Alabama, although there were over 240,000 acres of utility-line right of way in the state. A consultation with district supervisors of the Soil Conservation Service led to a decision to invite representatives of the major utility companies operating within the state to a meeting. The first meeting was called in 1958 at Carney Timber Company in Atmore, Alabama; subsequent meetings were held in Birmingham, Alabama; Selma, Alabama; and

Jackson, Mississippi. These meetings were attended by representatives of ten utility companies, as well as private landowners and personnel of state game commissions and the Soil Conservation Service.

One of the first points to be made at these meetings was that the primary concerns of maintenance personnel of natural gas companies differed in several aspects from those of the power and telephone companies. Gas company officials were concerned with two aspects, the first of which was reducing soil erosion in hilly areas. Pipes carrying natural gas are buried several feet below the surface of the soil. This excavation requires heavy equipment, and the ground is thoroughly torn up and mixed for several feet in depth; after the pipe is laid, the entire right of way is smoothed over by bulldozing. In hilly areas, erosion is a constant item of concern. Accelerated erosion results in exposure of the gas pipes, and thus entails refilling the exposed spots with soil. The gas companies reported the use of sand bags in terracing hilly areas as a means of combating erosion. Only one gas company reported using seed and fertilizer. The cost of refilling and sand bagging is high; one line superintendent reported costs of \$1,000 per mile per year in a hilly area in Alabama. The second concern voiced by gas companies dealt with the necessity for developing a low herbaceous ground cover so that gas leaks which discolor this type of vegetation could be spotted by the airplanes patrolling these lines.

Power and telephone company officials were not greatly concerned with the erosion aspect. In right-of-way construction by these companies, there is normally not enough soil disturbance to develop accelerated erosion. Native grasses such as broomsedge (*Andropogon* spp.), wire grass (*Aristida* spp.), plume grass (*Erianthus* spp.), and forbs usually develop a good enough ground cover to control erosion. These plants are not greatly affected by the spraying techniques employed by these companies. The greatest concern of the utility companies was the control of resurgent brush and tree sprouts.

During the course of these meetings, it became obvious that the utility companies were not motivated to change their procedures simply because of the information received from our work in Maryland; that work was evidently considered to be too atypical for the deep South and the data presented not comparable. Consequently, after the first meeting at Atmore, Alabama, a cooperative plan was made by the Soil Conservation Service and Carney Timber Company to develop, as a demonstration project, a plan for revegetation of 14 miles of rights of way located on forest land owned by the Carney Timber Company.

The demonstration area was located in North Baldwin County, Alabama. The land is somewhat hilly and gently rolling. The soil type is known as Guin; this term is used to denote mixed soils. Some areas are predominately sands; the others a mixture of sand, gravels, and clay. The right of way is maintained by the Alabama Power Company. Former maintenance consisted mainly of hand cutting. The right of way was bulldozed with a D-6 caterpillar owned by the Carney Timber Company. The estimated cost for "dozing" the right of way was \$15.00 per acre (based on a \$10.00 per hour equipment use).

Disking was accomplished with a farm tractor at about \$3.00 per acre. The initial cost of fertilizing was approximately \$8.00 per acre. The seeding and planting were planned to benefit turkey, deer, and quail, with the emphasis on the turkey. The various seed combinations which were tried and their estimated costs follow. Perennial rye grass (*Lolium perenne*), crimson clover (*Trifolium incarnatum*), and rescue grass (*Bromus catharticus*) were tried at an estimated cost of \$10.00 per acre for seed. Chufa (*Cyperus esculentus*), planted at the rate of 35 pounds to the acre, cost approximately \$4.00 per acre. Bahiagrass (*Paspalum notatum*) and ball clover (*Trifolium nigrescens*) were sowed at the rate of 15 pounds of Bahia seed and 2 pounds of ball clover per acre; the cost being approximately \$7.00 per acre. Kobe lespedeza (*Lespedeza striata* var. Kobe) sowed at the rate of 25 pounds per acre cost \$4.00 per acre. We have no seed cost information on African wild peanuts (*Arachis glabrata*) which were tried experimentally. Winter wheat (*Triticum aestivum*) and crimson clover have also been used. Wheat sowed at the rate of one bushel to the acre and crimson clover at the rate of 10 pounds to the acre cost approximately \$6.50 per acre.

Observations made on these plantings over the past five years revealed the following: chufa could not be maintained successfully longer than three years, even with annual disking and fertilizing and the addition of extra seed to fill in bare spots. It appeared that the build-up of Negro bug (family Cydnidae) populations, which suck the juice from the chufa tubers, and depletion of the soil nutrients limited the chufa development to a maximum of three years per plot. During the fourth year, it was necessary to rotate the chufa plantings to new ground. This rotation was easily carried out on the long right of way, and chufa plantings were spaced at about ½-mile intervals. The old chufa areas usually are abandoned for a year and then disked, fertilized, and seeded to winter legumes.

Kobe lespedeza plots produced well for three to four years before they needed renovation. The African peanuts proved to be a complete

failure. The perennial rye grass did not reseed satisfactorily. The Bahiagrass-ball clover combinations proved very satisfactory; but for best results, annual mowing and burning of the Bahiagrass was necessary. The crimson clover-rescue grass plots held up well when annual mowing and fertilizer were used for maintenance. Crimson clover appeared to be selectively used by deer in preference to grass or wheat. Turkey utilized the Bahiagrass seed during the summer months and ball clover herbage during late spring. Wheat seed was used extensively by doves and less extensively by turkeys. Kobe lespedeza seed was used by quail; the newly sprouted Kobe plants were used by turkeys in early spring. Kobe made seed and remained in fair abundance for three years without any maintenance even where range cattle grazed.

After two years of right-of-way development, negotiations were resumed by Carney Timber Company with the Alabama Power Company for cost-sharing assistance. It was pointed out that more than 500 people hunted on Carney lands annually and that providing supplemental feeding areas would increase the carrying capacity of game animals, which would in turn add up to better public relations for the Alabama Power Company. As a clincher, the power company was reminded that other open areas were available on Carney property for wildlife food plantings; and if cost sharing was not forthcoming, the right-of-way plantings on Carney lands would be abandoned. An agreement was reached whereby the power company agreed to pay the Carney Company \$50.00 per mile per year. Carney Timber Company agreed to maintain 14 miles of right of way free of brush and trees for the sum of \$700.00 annually. This agreement has been in effect three years and is mutually satisfactory to both parties. This income has enabled the Carney Company to continue to expand its wildlife food plantings, which are greatly needed since many of the mast-producing hardwoods have been eradicated and replaced with pine. The Alabama Power Company has also been able to keep its maintenance cost at a minimum.

After a second meeting in Birmingham, Alabama, the Southern Natural Gas Company and Alabama Power Company agreed to enter into memorandums of understanding between the landowner, the Soil Conservation Service, and the utility company. A sample of one of such agreements developed with Southern Natural Gas is as follows:

MEMORANDUM OF UNDERSTANDING BETWEEN SOUTHERN NATURAL  
GAS COMPANY AND LAND OWNERS

We understand the purpose of this test is to provide feed for wildlife and to prevent erosion or washing of the soil, as well as to reduce the amount of right of way cutting or clearing.

In order that our files may reflect accurately the understanding between you, land owner, and this Company, we will appreciate your causing at least one of the triplicate originals of this letter to be signed on behalf of the Soil Conservation Service and on behalf of the land owner, at the places indicated below, returning the same when fully executed to us; provided, of course, you agree that the following correctly states the responsibilities and extent of participating of the parties toward the accomplishment of the project:

(a) The Soil Conservation Service will write specifications for the project and will provide such technical assistance and supervision as necessary.

(b) The land owner will prepare the seed bed, acquire and apply the necessary seed and fertilizer, provided, however, that all work in connection with the preparation and seeding for the project on our right of way will be subject to inspection and approval by our District Superintendent, or his designed representative.

(c) Southern Natural Gas Company will, upon receipt of statement from the land owner, reimburse the land owner for the cost of initial seeding and fertilizer of the 100' x 5,659.5' (approximately 13 acres) test area, provided however that such reimbursement shall not exceed \$20.00 per acre for the approximately 13 acres area to be seeded and fertilized.

Any other or further test or experiment by the Soil Conservation Service involving Southern Natural's right of way shall be negotiated between the Soil Conservation Service, the owners of the land to be embraced in any such other or further test or experiment and Southern Natural Gas Company.

Both Alabama Power Company and Southern Natural Gas Company voiced a willingness to enter into such contracts covering the different physiographic areas of the state. An experimental area for testing different seed combinations was located in Tuscaloosa County, Alabama. The land was gently rolling with Red bay and Orangeburg sandy loam soils.

Seven plots about  $1\frac{1}{4}$  acre in size were located on a right of way of the Southern Natural Gas Companies. The seed combinations used were as follows:

- Plot 1—Bahigrass and Kobe lespedeza  
 2—Kobe lespedeza  
 3—Crimson clover and rye grass  
 4—Crimson clover and Kobe lespedeza  
 5—Crimson clover and Kobe lespedeza and rescue grass  
 6—Crimson clover and Bahigrass  
 7—Rye grass, Bahigrass, and Kobe lespedeza



All of the plots except #7 were prepared by disking, harrowing, and fertilizing with basic slag and potash. Plot #7 received no land preparation; seed was sowed and fertilizer and straw mulch were applied.

The only maintenance used was one annual mowing. After three years' time, examination of the plots revealed that the best combinations were Bahiagrass—crimson clover, and Bahiagrass—Kobe. Although Bahiagrass was dominant, there were enough patches of Kobe lespedeza and crimson clover to make these areas attractive to turkey, quail, and deer. After four years of use with no maintenance other than one annual mowing, Kobe lespedeza was the only plant still in evidence on the unscarified plot #7.

The Work Unit Conservationists in each county were requested to forward information concerning new utility-line construction work planned for their counties, along with the names and addresses of landowners who might be interested in entering into a cooperative maintenance agreement with the utility company. Plans were formulated to contact gas companies which were planning the laying of new gas lines and inform them of the advisability of seeding and fertilizing the bulldozed areas immediately after filling in the gas lines. It was felt that quick action in establishing a protective plant cover could greatly reduce costly erosion problems, especially in the hilly areas of Alabama. Meetings with SCS agronomists and Soil Scientists were held, and seeding recommendations were developed for the different major soils areas within the state. The seed mixtures recommended were made with due consideration being given for erosion control as well as for provision of supplemental food for wildlife. For example, the seeding recommendations given to the Dixie Pipe Line Company planning a gas line through central Alabama were as follows:

For Black Belt Alkaline Soils—Perry and Sumter Counties  
Mix:

Caley Peas ( <i>Lathyrus hirsutus</i> )—30 lb. @ 11¢ per lb. =	\$ 3.30
Lappacea Clover ( <i>Trifolium lappaceum</i> )—2 lb. @ 40¢ per lb. =	.80
Hop Clover ( <i>Trifolium dubium</i> )—1 lb. @ 60¢ per lb. =	.60
Tall Fescue grass—6 lb. @ 17¢ per lb. =	1.02
39 lb.—Estimated cost per acre	<u>\$ 5.72</u>

For Sandy Acid Soils of Coastal Plain (other counties) Mix:

Rye Grass—10 lb. @ 9¢ per lb. =	\$ .90
Giant Hop clover ( <i>Trifolium procumbens</i> )—	
½ lb. @ 60¢ per lb. =	.30
Bahiagrass—8 lb. @ 35¢ per lb. =	2.80

Reseeding Crimson Clover—8 lb. @ 28¢ per lb. =	2.24
26½ lb.—Estimated cost per acre	\$ 6.24
(Add ½ lb. per acre weeping love grass on steep hillsides.)	
Fertilizer—400 lb. 4-12-12 @ \$1.80 per 100# =	\$ 7.20
Appropriate cost per acre =	\$13.44 or
\$65.60 per mile of right of way, 40' wide.	
(4.84 acres x pounds of seed per acre = pounds of seed per mile.)	

The gas companies made the planting as recommended. Later checking on the success of these plantings on steep hillsides indicated that there was not enough rye grass to keep the soil from washing. New recommendations called for doubling the rye grass seeding to 20 pounds per acre for hillside areas, so that a protective ground cover could be quickly established.

Repeated attempts were made during planning sessions to interest the maintenance personnel of power companies in the low-cost technique (Arner 1960) of prescribed burning for right-of-way maintenance. Invariably the power company officials voiced the same following objections: (1) The heat generated by fire would damage the suspended cables. (2) Wooden poles (still used on a number of lines) would catch fire. (3) The cost of preventing fires from spreading to adjacent forest lands would be prohibitive.

Investigations at Mississippi State University refuted the validity of these objections. Maximum-minimum thermometers were suspended approximately 12 feet above the ground where the controlled burning was going on. The maximum temperatures did not exceed 150° F and rarely attained this temperature. A power line right of way over one mile in length containing wooden poles was burned without any protection provided for the poles. During the burning operation, the poles were watched by personnel with fire fighting equipment, but no portion of these poles was ignited. Costs would be increased only slightly if poles surrounded by highly inflammable vegetation were protected by plowing a fire lane. In most instances, such precautions would not be necessary. It was found that the total cost of fire plowing, burning (using 5 men), and travel time to and from the burned area was well under \$7.00 per acre. Foresters for large wood-using industries in the area report strip burning costs as low as \$4.00 per acre.

Research involving fertilizing and seeding burned areas was conducted over a period of years and will be reported in detail in another publication. It was found that Kobe lespedeza, sericea lespedeza (*Lespedeza cuneata*), partridge pea (*Cassia fasciculata*),

and Florida beggarweed (*Desmodium tortuosum*) would make excellent stands where the seed was sowed directly on the burned area and 400 pounds of 0-14-14 fertilizer was used per acre. No other land preparation was necessary. It was shown that resurgent woody vegetation was significantly reduced by burning. In the upland areas of most of the South, burning every third or fourth year would be necessary for maintenance.

A technique which has received a great deal of publicity, especially in the northeastern United States, was frequently brought up during discussions at planning sessions. This technique involves a basal spray which is selectively applied to objectionable woody plants. The eradication of the undesirable plants permits the desirable plants to spread into these openings. The theory is that there are many shrubby plants which are good wildlife food plants growing on rights of way, and if they are just given growing room, they will eventually dominate the right of way. Many miles of right of way in Alabama, Mississippi, and Maryland have been examined, but no areas were located where there was a sufficient number of desirable shrubby plants growing to experiment with this technique.

The plant communities found dominating these upland areas were composed largely of perennial grasses of the genera *Andropogon*, *Panicum*, *Aristida*, as well as of pine seedlings, sumac (*Rhus* spp.), perennial lespedeza, goldenrod (*Solidago* spp.), aster (*Aster* spp.), blackberry and greenbrier. Smith (1959) reported broom sedge, blackberry, aster, and pine as being among the ten most common plants found on bulldozed rights of way on the Piedmont of North Carolina three years to six years after dozing. He also reported that selective basal spraying was not practical in this area of North Carolina.

A segment of power line right-of-way approximately one-half mile in length which had been sprayed earlier was intensively sampled for shrubby plants by the wildlife techniques class from Mississippi State University. Six lines, each 2100 feet in length, were sampled with the shrubs being counted for a distance of three feet on either side of each line. The total number of shrubs counted were as follows: Wing-rib sumac (*Rhus copollina*) 198; low bush huckleberries (*Vaccinium* spp.) 52; (*Hypericum lobocarpum*) 25; and wild roses (*Rosa* sp.) 4; for a total of 278 shrubs. The probability is slight that with this stand density these shrubs could successfully dominate the right of way and suppress pine and hardwood trees. Even if it were possible to develop some stabilization with these shrubs, the quality of food could not compare with clover or lespedeza grown on a fertilized right of way.

## CONCLUSION AND DISCUSSION

Cooperative work between the Maryland Game Commission and a power company was initiated in 1948 with a simple memorandum of understanding; seven years later cost computations showed that the total cost for the power company was \$6.00 per acre and for the game commission was only \$1.50 per acre per year.

Cooperative planning with soil conservation district supervisors, utility companies, and landowners was started in Alabama in 1958. Demonstration projects were established in the different physiographic areas of the state. Information gleaned from these projects has pointed the way for reduced right-of-way maintenance costs as well as reduced costs for establishment of feeding areas for forest game species. (1) In both the upper and lower coastal plain of Alabama, seedings of Bahiagrass combined with crimson clover, ball clover, or Kobe lespedege effectively retarded brush and provided highly nutritious summer and winter food for game. (2) The only maintenance given these plantings was one annual mowing; however, three years after a sod was established, these areas still had a fair stand of clover growing with the Bahiagrass. It was also found that plantings of chufa could be economically maintained on the lower coastal plain by rotating these plantings to new ground the fourth year after establishment.

Prescribed burning proved to be the most economical and practical of all the maintenance techniques studied. Costs were less than \$7.00 per acre; based on a three-year rotation, the costs would be just a little over \$2.00 per acre per year. The objections voiced by power company officials to burning were found to be without fact.

Only a fraction of the several hundred thousand acres of utility line rights of way in the southern states have been cooperative managed for dual use. The job of initiating and coordinating utility line right-of-way maintenance work on a statewide basis will require the ability of a good public relations man who is also a well-trained plant ecologist.

The technique of spraying with herbicides is strongly entrenched in maintenance work of utility companies. Tact and patience are necessary in selling new techniques to utility company officials; however, these officials are sensitive to public opinion and to the possibilities of reduced maintenance costs. The exploitations of these aspects should result in a significant increase in supplemental feeding areas for game species.

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## THE FOX RABIES CONTROL PROGRAM IN TENNESSEE, 1965-66

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Since 1940, rabies has become quite prevalent, or at least more apparent, among foxes in the eastern and southern United States. Fifty percent of the nation's human cases of rabies, in recent years, have been ascribed to exposure to foxes, skunks, or bats. The wildlife-rabies problem has been compared to looking at an iceberg—only a small part of it shows.

Rabies has become a serious and continuing problem in Tennessee. This paper presents the administrative and management problems faced by the Tennessee Game and Fish Commission as a result of the rabies epizootic of 1964-65. Mr. James Hammond supervised the trapping and poisoning programs. Mr. Eugene Legler tabulated the trapping and hunting success records. Their considerable assistance is hereby acknowledged.

In 1964, Tennessee reported more cases of wildlife rabies than any other state in the United States. Foxes comprised the largest number of positive heads, as they had in the eight previous years (Figure 1). The percentage of fox heads submitted which were positive increased from 26 in 1963 to 65 in 1964. Laboratory examinations indicated 405

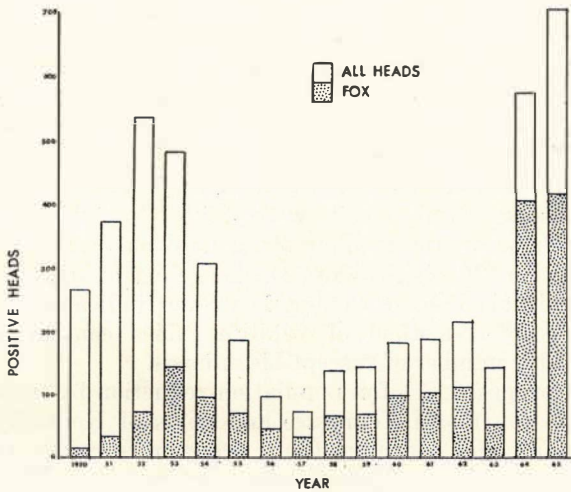


Fig. 1. Total heads and fox heads positive for rabies, Tennessee, 1950-1965.

FIG. 1. Total heads and fox heads positive for rabies, Tennessee, 1950-1965.

foxes, 30 skunks, 13 bats, 4 bobcats, 68 cattle, 31 dogs, 16 cats, and 5 other animals positive for rabies in 1964. Approximately 5 percent of the fox heads submitted were from red fox (*Vulpes fulva*) and the remainder were grey fox (*Urocyon cinereoargenteus*).

Foxes were probably the responsible agent for large numbers of rabid cattle and an increasing number of positive skunks (Fredrickson, 1965). Many of the human contacts with rabid animals also involved foxes.

The disease outbreak was actually two epizootics separated by over 200 miles. The key counties, in numbers of rabid foxes reported in 1964-65, were Franklin, Lincoln, Williamson, Maury, Marshall, and Davidson in middle Tennessee and Washington, Jefferson, Cocke, Sullivan, Hamblen, Greene, and Hawkins in northeastern Tennessee.

Beginning in December, 1964, rabies received considerable attention from the state's news media. The headings from editorials indicate the type of concern being expressed: "State must act faster to curb rabies epidemic" (Anon., 1964a:4) and "Rabid animals repel tourists" (Anon., 1964b:8). The Tennessee State Legislature was meeting in Nashville and found it easy to convey the feelings of their constituents to the Governor and state government branches.

Continuing dramatic press coverage: "Bitten, felled, man chokes fox to death" (Anon., 1964c:12), "2nd fox grips farmer's leg, then is killed" (Anon., 1965a:1), "The war against the mad foxes" (Anon., 1965b) led to a type of mass hysteria in some counties.

Public concern was reflected in a statewide \$3 bounty proposed in the Legislative House. Enactment of such a bounty would have been of doubtful value. The wastefulness and ineffectiveness of bounty programs have been well documented (Brooks, 1962).

Interested public agencies from Tennessee and neighboring states met and discussed the problem and possible control methods. The United States Department of Public Health and the Southeastern Wildlife Disease Study Unit were asked to design a plan for controlling the epizootic. In January, a Regional Rabies Control Plan was presented by R. Keith Sikes, D.V.M., chief of the Rabies Unit at the Communicable Disease Center. Dr. Sikes indicated that the only presently accepted method of wildlife rabies control is based on reduction of the number of susceptible animals.

The plan proposed (1) fox population reduction by trapping in the eastern three-fourths of Tennessee and parts of Kentucky, Virginia, North Carolina, and Alabama, (2) a program to reduce rabies in domestic animals and (3) a public education program. Within Tennessee, the area to be trapped contained 28,000 square miles and the estimated control costs were \$200,000.

Commission funds were not available for such a control program. Trapping a 10-20 mile buffer zone around the epizootic area was impractical because of the wide spread of the disease and limited funds.

The Tennessee Legislature showed its concern for the rabies problem by passing Bill 51-421. This bill stated that "the Director of Game and Fish, or any person or persons designated by him, may use any chemical, biologic substance, poison . . . when it is considered necessary by the Director to reduce or control any species that may be detrimental to human safety, health or property." No action shall be taken until the county board of health, in the affected county, establishes a quarantine on domestic stock and makes an official request, thru the State Commissioner of Public Health, asking the Director of Game and Fish to take action. The chain of requests is from the people, through their county and state public health representatives, to the Game and Fish Commission. The bill also requires legal action in the form of the request from the County Board of Health.

The State Attorney General ruled that this bill supersedes 28 county acts which regulate the season on foxes.

#### PRE-CONTROL SURVEYS

Mouse, vole, shrew and rat populations were sampled in the epizootic area. These animals might serve as vectors of the disease. Because rodents are important fox foods, high rodent populations might also precede or coincide with a general increase in the fox population. Two study units containing optimum small-mammal habitat were selected in Williamson County. The snap trap method (Stickel, 1946) was used to obtain a relative index to small-mammal populations. The traps sampled 3 to 6 acres, assuming the cruising radius of the rodents is 70 to 150 feet (Buckner, 1957).

In seven days trapping, 344 mammals were removed from the units. Voles (*Microtus* sp.) comprised 66 percent of the mammals caught. The catch in the first three days was used to compare with those populations of similar studies.

Small mammals were abundant within the epizootic area in Williamson County. There were 3 to 17 small mammals per acre on one unit and 14 to 31 on the other. Populations found in other studies varied from 4 to 9 (Buckner, 1957) to 23 per acre (Stickel, 1946).

There was no evidence to indicate that a high rabbit population preceded or coincided with the fox rabies epizootic. The statewide hunting success in kill per hour indicated that the years 1961-63

provided below average rabbit hunting success and the 1964 season provided average hunting.

An attempt was made to evaluate the control effort by censusing foxes before and after control. Two methods of acquiring fox population indices were tried. The scent post method (Wood, 1959) was unsuccessful because hard rainfall, followed by freezing weather, prevented the reading of track sign for several days. The other method was based on the number of foxes responding, at night, to a rabbit distress call (Weem's predator call).

Twenty-six foxes were seen on 150 ten-minute stops. The calling method was used for hunting as a part of the control effort and was also popular among the private bounty hunters. This destroyed its usefulness as a potential post-control index because we suspected the surviving foxes became call shy.

#### CONTROL EFFORTS

##### *Trapping*

Trapping personnel included rabies control officers, biologists, wildlife management area personnel and officers of the Game and Fish Commission. Some were experienced in fox trapping, but all received approximately one week's training from Communicable Disease Center and United States Bureau of Sport Fisheries and Wildlife personnel. This training period was considered as part of the control effort as soon as the traplines were established. The men worked in pairs.

In the beginning, permission was obtained from all landowners before traps were set. An estimated 15 percent of the landowners refused to allow trapping. Later, to save time, traps were set along the road right-of-way.

"Dirt hole" sets were the most common trap set used. Cracklings and/or urine were used as the attractants.

Trapping took place in Williamson, Wilson, Greene, Roane and Union Counties with each of the 28 crews working two to three weeks. Pet quarantines were in effect in these counties. A total of 137 grey, 27 red, and 27 unidentified foxes were trapped. Williamson County received the most attention with 504 man days trapping and a capture of 98 foxes (5.14 man days/fox) and 526 other animals including 92 dogs, 71 cats, 56 skunks, and 173 opossum.

##### *Hunting*

In two counties, the trapping crews also hunted for foxes at night using predator calls in the same manner that calling routes were made. The most profitable hunting method was to select a country



roadside where hedgerows or other travel lanes provided cover for the fox to move toward the road but not to the immediately vicinity of the car. If the fox got too close he was usually frightened. In completely open areas the fox wouldn't approach close enough for good shooting. When a fox was observed it sometimes took 20 to 30 minutes to coax him within range of 12-gauge shotguns or .225, .243, and .22 magnum scoped rifles. The 12-gauge standard shotgun, with number 4 short magnum shells, seemed most effective. The total hunting kill was 59 foxes and 38 other animals.

In Williamson County, twenty-two nights were involved and 147 man nights effort. Fifty-three foxes were shot for an average of 2.77 man nights per fox (approximately 8 hours per man night). Thirty cats and four other animals were also killed.

Comparatively speaking, hunting was the most selective removal method and required less effort per fox killed. It was an effective way to supplement trapping and was popular among the control teams. Traps have the advantage of removing large numbers of free-running dogs, cats, and other animals that present a substantial reservoir for disease.

#### *Control by Chemicals*

Strychnine was used in 1965, within the Holston Ordnance Works in Hawkins County. Cattle grazing leases were permitted inside this fenced, 6,000 acre area and several cows contacted rabies. Numerous foxes were observed by guards. The Tennessee Game and Fish Commission was asked to reduce the fox population within the Ordnance Works.

One-fourth grain strychnine tablets were placed within  $\frac{3}{4}$ -inch squares of beef suet. During a 17-day period, 226 bait sets were made and 145 baits were accepted. Few carcasses were found, but this was expected because the poison usually allows considerable movement (10-30 minutes) after the bait is eaten. Foxes were not observed after the poison was distributed.

More recently, in February, 1966, officials of Carter and Washington Counties requested rabies control assistance. In Carter County, eight biologists set out 1,179 strychnine-treated baits over a five-day period. A valley containing 20 square miles was treated and 596 baits were accepted.

Snowcover permitted identification of the animals accepting the bait except when several animals had been around the bait set. Animals accepting baits including 65 foxes, 135 dogs, 25 cats, 202 rodents or birds and 129 unknown. Humans removed 35 baits in this heavily settled valley. No effort was made to confirm the death of

animals accepting bait, but some dead animals were found. Bait acceptance declined toward the end of the baiting period.

Gassing dens was tried on a small scale. Foxes were driven from some dens and captured or killed. Larvicide, smoke bombs, and tear gas were among the items tested.

#### *Control by Private Citizens*

Six counties established bounties on foxes varying from \$2 to \$5 for each fox or parts thereof presented to the county clerk. Monies budgeted for the bounty fund were set by the county courts and varied from \$2,000 to \$2,500. The funds were soon exhausted but did provide an incentive for action by private citizens.

Trapping and hunting by private individuals was common in these counties and the impact on the fox population was greater than the state's control program. Bounties had the disadvantage of exposing a greater number of citizens to rabies infection.

The public became interested in the publicized night hunting methods employed by state control teams. People began hunting for sport and bounty funds. Supplies of predator calls were exhausted in Nashville and neighboring counties.

#### *Results*

In 1965, the six state laboratories examined a total of 706 positive animal heads which included 414 foxes, 42 dogs, 23 cats, 74 skunks, 30 bats, 5 bobcats, 6 horses, 101 cattle, and 10 other animals. This new record for positive fox heads occurred in spite of the fact that submission of heads was discouraged unless some human contact was involved. In the summer of 1965, the epizootic diminished.

If population reduction was sufficient, the control counties should have shown a reduction in diseased foxes within 30 days. The control program and fox reduction by private citizens occurred in February and March. In Greene and Williamson Counties, 13 percent of the cases occurred in May thru December and in non-control counties 21 percent of the cases were in the same period.

It is impossible to state what part of these differences were due to the control efforts, inherent fox populations, or population reduction by the disease. Ironically, in the winter of 1965-66, the Commission received several requests from fox hunters asking that foxes be restocked in Greene County.

Critics question the advisability of a costly trapping effort which could provide only temporary population reduction. They also point out that the disease would have naturally died out without control action.

In retrospect we can see that some control action was necessary to allay public fears, and to reduce human exposure and domestic animal losses. The result of a no-action approach would very likely have been a burdensome statewide bounty program that would have made the \$40,000 control expenditure look insignificant. The over-all public relations impact of the control effort was considered good.

We would prefer to avoid a perpetual control program. However, if further control efforts become necessary we now have personnel trained to poison, trap, and/or teach landowners to trap.

### *Problems*

The "dirt hole" set is the most effective set for foxes and should be made legal. Tennessee laws specify that it shall be unlawful to place steel traps in the open, except for water sets. The State Attorney General ruled that this law made ground-surface sets illegal. In view of our fox population problems, the legitimate trapper should not be handicapped.

In a similar vein, a law prohibits the hunting of wildlife at night using a light. It is pointless to prohibit hunting foxes in this sporting manner when we have a harvestable surplus. Here is a chance to develop an additional hunting opportunity at a time when many other hunting opportunities are declining.

### ECONOMICS

Expenditures for the 1965 control effort totaled \$39,722.00 or \$207.96 per fox killed. The salary and travel time for two federal and two state public health personnel are not included. The expenditures were \$7,129.40 for travel, \$7.47 for communications, \$7,253.93 for supplies and equipment and \$25,331.24 for salaries.

It should be pointed out that initial equipment costs could be prorated over several years. Also, this was essentially a training program and resulted in more effort per fox than is typical for experienced trappers. The winter weather made trapping more difficult, and tracking snows indicated fox populations were already low in the trapping areas.

In Virginia, four experienced men trapped 82 foxes in 16 days, or 1.28 fox per man day (Marx *et al.*, 1963). In New York, over a five-year period (1954-58), it cost \$26 per fox trapped (Linhart, 1964).

Total cost of the 1964-65 epizootic, to the state's economy, exceeded \$300,000. In 1964 and 1965, approximately 400 cattle died from rabies at a loss valued at \$60,000. Veterinarians reported 154 cases of cattle rabies in 1964 or 140 percent more cases than lab reports indicated.

An estimated 1,000 persons received rabies exposure treatment in Tennessee in 1964 and 1965 at a cost of \$100,000. Half of these exposures were in Williamson and Greene Counties. Lost work time and other related expenses probably amounted to another \$100,000.

Average annual losses (1954-63), as a result of rabies, were estimated at \$27,000 per year. Of course, all of this could not be ascribed to exposure to rabid wildlife. In an average year, 29 positive cattle heads are examined and an estimated 41 cattle die. Figuring an average of \$160 per cow the loss amounts to \$6,500 per year. Average annual expenditures for rabies exposure treatment (100 persons) and lost work time might amount to \$20,000.

From 1954-63, an average of 22 Tennessee counties annually reported cases of fox rabies. In an average year, four counties have more than five cases of rabid foxes. If control efforts could be directed at these four counties, they would involve an average of 1,420 square miles.

Assuming that our poisoning campaign would effectively reduce economic losses to rabies 100 percent, cost could not exceed \$19 per square mile, on the 1,420 square miles, to achieve a 1:1 cost-benefit ratio. It cost \$2,400 for the 1966 poisoning campaign in Carter County or \$120 per square mile. Participants estimated 50 to 100 foxes were killed at a cost of \$24 to \$48 per fox. Based on our experiences in Carter County, we can probably reduce our poisoning control costs to \$30 per square mile. Further reduction of our costs will be necessary before we can justify wildlife population control work on the basis of economics.

#### FUTURE STUDY NEEDS

Fredrickson and Thomas (1965) have shown a relationship between fox rabies cases (1946-61) and caves in Tennessee. Tennessee's only statewide survey of fox populations (1951-53) was based on farmer interviews (Shultz *et al.*, 1954). Surveys of farmers provide a suitable fox population index (Lemke and Thompson, 1960). When Shultz's data were broken down into a county-by-county index there was no positive correlation with the fox rabies cases (1946-61) or cave distribution in Tennessee. It appears that fox rabies in Tennessee is somehow related to caves and that chronic sylvatic rabies problem areas do not necessarily correspond with fox population levels.

When chronic wildlife rabies problem areas in other states—Florida (Jennings *et al.*, 1960), Virginia (Marx and Swink, 1963), New York (Linhart, 1960), Georgia and Alabama (Wood, 1954)—are compared with cave distribution in the United States (Folsom, 1962), a relationship, similar to that reported for Tennessee, appears to exist.

Studies are being conducted, in cooperation with the Tennessee Department of Public Health, on the ecology of wildlife rabies (Fredrickson, Lewis, and Wheeler, 1966). Initial findings indicate need for further study on fox-bat-cave-rabies ecology in Tennessee.

Rabies research has not yet eliminated the possibility that the bat or some other animal acts as a disease reservoir which periodically reintroduces the disease to carnivores. Aerosol transmission within caves or bat-to-fox transmission by bite are means whereby susceptible fox populations might be reinfected. Further research is needed to find a more economical and practical manner of controlling sylvatic rabies.

#### SUMMARY

In 1964, Tennessee reported more cases of wildlife rabies than any other state in the United States. An epizootic was in progress in late 1964 and early 1965. Intensive news coverage led to widespread public concern. The only method available to cope with this epizootic was a program to reduce the fox population density. The United States Public Health Service recommended that the control program involve 28,000 square miles east of Kentucky Lake. The estimated cost of the recommended effort was \$200,000.

Trapping teams were trained by specialists of the Bureau of Sport Fisheries and Wildlife and the United States Department of Public Health. Trapping was conducted in five counties and 191 foxes and 932 other animals captured. Foxes were also hunted, using predator calls, and 59 foxes and 38 other animals killed. Some chemical control was tried in 1965 and 1966. Cost and man days of effort are presented. Future study needs are discussed.

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## DISCUSSION

DISCUSSION LEADER CRAWFORD: Thank you, Jim Lewis, for a fine review of a state public health problem dealing with wildlife rabies, in this case, the fox.

I think it is very evident that we are accumulating a great volume of information across this country on wildlife rabies, particularly fox-based outbreaks. We have had cases in Florida, Virginia, New York, Georgia, Alabama, and I know Missouri has been through a couple of these. Surely from this volume of literature and research findings we must be able one of these days to hit upon the solution.

MR. DON CLYDE (Utah): I would like to ask the gentleman a question. In the control of these foxes, you stipulated, I believe, that the lower legislative house passed a bounty law. I think the gentleman is opposed to that. I think he stated emphatically that he was. He went on to say on costs, if I understood him correctly, that it took five man days for each fox that was poisoned or killed. I don't know what you pay those men, but certainly that was not \$100.

I just want to clear the question: Why are you opposed to a bounty when I am sure it was by far the cheapest method?

MR. LEWIS: I am opposed to a statewide bounty. These county bounties, which were temporary, proved to be a pretty effective manner of reducing fox populations cheaply, but it cost us as I mentioned, \$208 per fox taken in our 65 controlled efforts. The bounty was in effect in only six counties. The bounty program introduced in the legislative house was for a statewide bounty, and it did not pass.

MR. CLYDE: I guess I am a little stupid, but I can't quite see that you have answered the question.

MR. LEWIS: There was also a little tricky business on the county level. We know there were a certain number of foxes brought in from adjacent counties where there was no rabies problem and bountied in the county that offered the bounty. They were foreign foxes. They were not actually foxes from the population involved in the epizootic. And that is one of the things you run into with a statewide bounty program, misuse of funds, and generally it is thought to be ineffective.

MR. CLYDE: What was the bounty, may I ask?

CHAIRMAN STANSBURY: Could I step in on this because this was my responsibility under this particular situation. I would like to explain it like this.

We felt that we should assume responsibility for wildlife diseases that were communicable to people. We had a law passed by the legislature that, rather than a bounty law, would give this responsibility to the Game and Fish Commission directly through the Public Health Department with a procedure back through the county health department to set the stage for quarantines.

And too, you must remember that we had no one on our staff who was trained as a trapper. That was one of the reasons for the high cost. There was no assumption on the part of the Commission at that time of responsibility for the control of this problem.

We felt that we could better control it through a local quarantine effort with the county going to the State Health Department and then to the Commission, because then you had public relations on the local level to deal with.

We felt this procedure was better than establishing a bounty where the trapping was continuous from year to year.

We hit the real problem areas and through the health department that obtains these specimens, we could keep on top of it better than through the scatter approach of the bounty system.

Does that answer the question? This was our determination whether you agree or not.

MR. CLYDE: Yes, I think that helps some. I notice, however, that running through the program there is an objection to any kind of a bounty system.

Of course, the Federal Bureau of Sport Fisheries and Wildlife are solidly against it, and I am sure I don't want to infringe on your time to tell you why, but out in the western United States we use bounties. We use them very successfully.

We don't have much trouble with foxes, but coyotes and cougars, we can catch for a very much smaller cost than we can trap them or we can poison them or have them taken by Sport Fisheries and Wildlife.

So I don't want to make an issue of it, but thank you.

DISCUSSION LEADER: Thank you very much.

MR. RICHARD CRONIN: About two years ago we had two cases of rabid bats, and we have had somewhat of a buildup in the fox population.

What is the danger there? I mean, is there a possibility that something would be happening?

MR. LEWIS: Well, if it was in free-living bats, we are not sure if there is a spillover that occurs from free-living bats into fox populations.

Constantine recently published some work that he did in which he infected bats and then made them bite both foxes and coyotes, and it did produce rabies in both species by bite transmission which, to my knowledge, hadn't been proven before.

The work that we have been doing through pilot studies in Tennessee has involved studies of relationship between the fox and the bat with the bat as a possible food of the foxes in cave areas where we have large colonies of bats. In some situations the bat may be vulnerable to predation and there is a possibility of contact there, the fox either ingesting the rabid bat or being bitten as he feeds on it. There have been some studies that have shown that just ingestion of a rabid animal, or at least the virus or infected brain material, has produced rabies.

DR. E. PAUL CATTS (University of Delaware): Is this annual economic loss due to rabies principally through cattle deaths, or is there some other livestock involved?

MR. LEWIS: It is principally cattle, and I included in that estimate the average number of persons that receive rabies exposure treatment which costs them \$100 per series of shots.

DR. CATTS: Is this after they are bitten?

MR. LEWIS: Yes, and also included is an estimate of lost work time.

DR. CATTS: Could I make one more comment, please.

We are doing an ecological study on woodlots. This relates to the rabies problem, although our potential reservoir here is skunks and not foxes because these are in more urban areas. I want to bring our investigation out because it points out the need for a compromise when you approach the work on these reservoir animals.

The skunks are prevalent seasonally in woodlot areas which would be used as, let's say, picnic areas or something like this by the public. These areas also serve as nesting sites for yellow-jacket wasps. The yellow-jacket wasp populations hit

their peak at the end of the summer, and we have located some 55 nests in a 35-acre area.

By the end of October, every one of these nests had been removed by skunks, had been dug up and destroyed. On one hand the skunk is a potential rabies reservoir, and on the other hand, the yellow-jacket wasp is a potential source of anaphylactic shock to persons using the picnic area. They may drop over in shock after being stung in a multiple attack by the wasps.

So on the one hand you are running the risk of rabies with the skunks, and on the other hand, they are doing a service by wiping out the yellow-jacket wasp population.

There is a need for compromise here and an ecological approach to the problem.

MR. LEWIS: I thank you, and I suspect there have been a lot more deaths from wasp bites than there have been from rabid animals. There were two human deaths in 1964 and 1965, I believe due to rabies, so it is not a big problem as far as deaths are concerned.

DISCUSSION LEADER: I haven't seen any dog men get up this morning but I understand that dogs were involved in this trapping program and I know in some areas of the country this very much complicates the whole problem.

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## WILDLIFE AND HUNTING ON COMMERCIAL FORESTS IN MAINE

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The value of game, and especially deer, to the economy of the State of Maine is considerable, and the term "Vacationland" applied to the state is symbolic of its classification in the northeastern United States. A 1964 postal survey of hunters' expenditures in Maine (Gill, 1965) provided information to the effect that more than 24 million dollars were spent during the year, of which 6 million dollars were spent by non-residents. Nearly 80 percent of the expenditures were for deer hunting. In looking to the future, economists continue to classify Maine as a vacationland area which is expected to be used by the residents of the "megalopolis" extending from Boston, Massachusetts, down the Atlantic coast to Richmond, Virginia. Whether or not the expected increase in population will actually create additional hunting pressure in Maine may be debatable, but the importance of hunting opportunity here will undoubtedly increase as the years go by. In view of this potential, the improvement in game habitat, especially for deer, is highly desirable as long as deer numbers are not allowed to exceed their carrying capacity, thus nullifying any possibility of successful habitat improvement.

Approximately 80 percent (nearly 17 million acres) of Maine is forested (Banasiak, 1961). The major manufacturing industry is pulp and paper, and the management of forests is primarily for white spruce and balsam fir, although a moderate but increasing amount of hardwoods is being utilized in this industry. We welcome this



increased use of hardwoods. Generally, the roads in the forested areas of northern and eastern Maine are built and maintained by the various timber companies in areas they own. One major difference within this forested area is that in the western part softwoods are much less prevalent and occur in the valleys, whereas in the northern and eastern parts the softwoods are much more prevalent and occur even to the tops of the hills.

Land ownership patterns have changed somewhat from historical days when charters for huge tracts of land in Maine were granted by the Commonwealth of Massachusetts to single owners. Many sections of northern and eastern Maine are still designated on maps by the name of the purchase or survey division under which early transfers were made. Although the land has since been sold in smaller parcels, ownership is still in blocks consisting of as many as eight or ten 36-square-mile towns in several instances, some with a single company as owner and others with combinations of two or three companies owning undivided shares. This type of land ownership facilitates the working relationships for the game biologists since it keeps to a minimum the number of contacts necessary in conducting game management work.

While the climate has had the controlling influence on forest growth, it has had a decided influence on game conditions as well. Our three major game species, the white-tailed deer, ruffed grouse, and snowshoe hare, have adaptations which are helpful to their survival during the winter months. The ability to live on twigs or buds of woody plants is common to them, and changes in pelage of the hare and deer and conformation of the feet of the grouse and hare are adaptations which are essential to their well being. Even with these adaptations deer have difficulty surviving winters if deep snows without crusts, low temperatures and strong winds persist over a long period. This is especially true when food conditions in deer wintering areas are limited or of poor quality.

Maine has been divided into four climatic zones (Fig. 1) and it is in the northern zone that winter conditions are quite consistently severe enough to force deer into areas of softwood growth where snows are less deep, winds are not as strong, and the chill is not as great. We normally expect a confinement period of about six weeks in northern Maine. It is in this zone where land ownership is often in large blocks.

Snow depths have been recorded at various stations by the U.S. Weather Bureau, and the average maximum depth for the northern climatic zone varies from 31 to 63 inches in hard winters, half that amount during very mild winters. Total snowfall in the area is generally over 100 inches. It has been determined that deer will travel

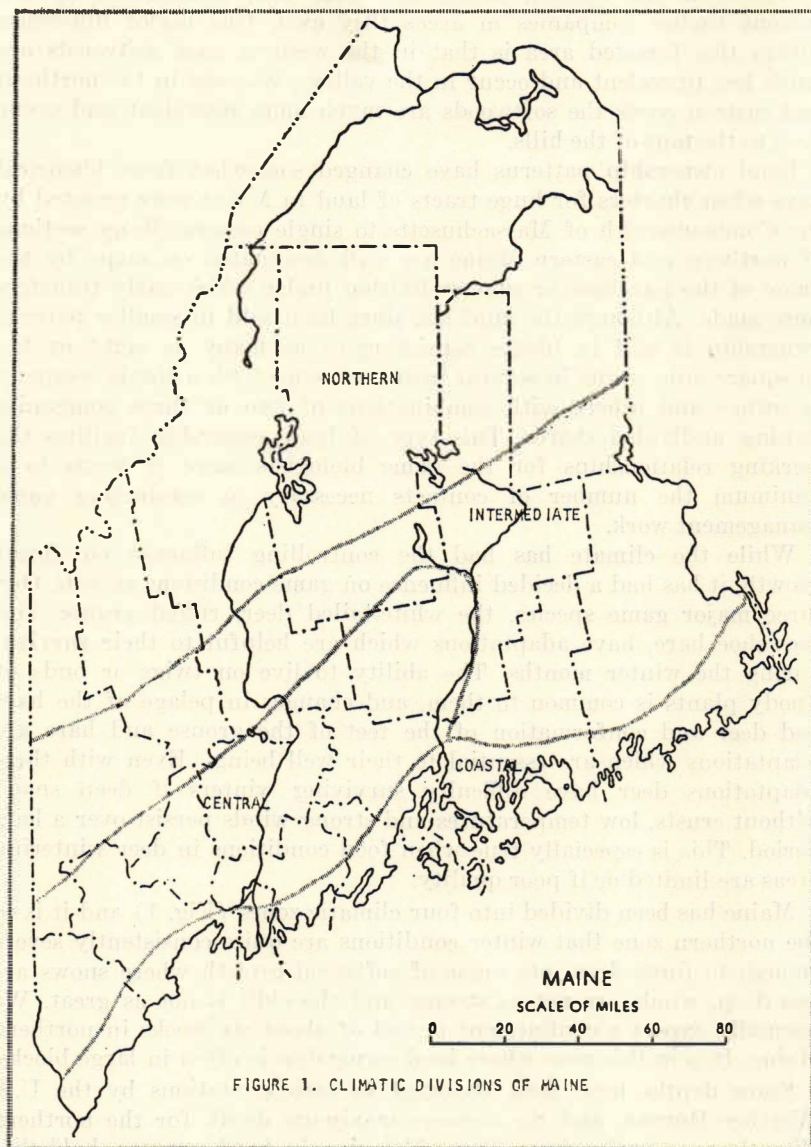


FIGURE 1. CLIMATIC DIVISIONS OF MAINE

freely while sinking as much as 24 inches in loose snow. But snow depths tell only part of the story—the remainder concerns snow conditions. Usually one or more thaws occur during January or early February and the deep, light snows settle and form a crust strong enough to withstand the weight of a deer. This has the effect of raising the deer to a higher level and brings additional food within reach. It also often bends smaller trees down with the weight of the wet snow, so that additional food is temporarily available. Crusts which do not support the weight of the deer are a detriment rather than a help as they often confine the deer while allowing lighter predators to travel freely. Low temperatures, especially when accompanied by high winds, readily force deer into their yarding areas where protection from these elements is afforded.

#### DEERYARD MANAGEMENT

It is obvious then that the management of deer in Maine must include such measures as are economically feasible to improve or maintain winter habitat. While similar work is being done in other northern areas, such as our neighboring state, New Hampshire, I believe we must recognize that this work is still experimental, despite its magnitude in some cases. It is a relatively new endeavor, and there are several variations of practices which could and should be tried. The initial suggestion in Maine was made by Mr. D. B. Demeritt, former woodlands manager of the Dead River Co. Several years ago major landowners in the area of concern were contacted collectively and generally at forest forums and individually at the management level. When it was possible to demonstrate the type of cooperation we were asking of them, they readily accepted and were anxious to get the program started. Two companies were already doing a creditable job of deeryard management as an intentional by-product of their commercial operations. The signing of an agreement by the president of the company and the Commissioner of Inland Fisheries and Game is the first official step taken. This provides an opportunity for publicity which creates an awareness and appreciation of the company's intentions by the sportsmen. Following the signing of this agreement, more specific work begins in the field and contacts with local foresters are made.

Two major types of deeryard management practices are being used in Maine, (1) specific yard and (2) strip. In the western part of the deeryard problem area, where the softwoods occur in valleys or pockets, the *specific deeryard method* of management is the more acceptable to landowners (Hunt, 1966). It requires the full time of one deeryard management biologist to conduct this phase of the work.

He begins with a company by inspecting its aerial photographs, timber inventory maps and cutting plans—an operation which requires a high degree of confidence on the part of the company since these documents are highly secret. Building this confidence has taken time but is an established fact. Having a knowledge of deer habitat in areas where cuts are planned, this biologist inspects the deeryards of concern with at least one inspection made jointly with the local company forester. Verbal agreement is reached here as to the boundary of the area to be reserved with no cutting, the recommended location of roads, and the usually non-merchantable hardwoods in the peripheral area which should be cut and left in the woods to provide immediate food and future sprouts. Then a plan is drawn for each deeryard, setting forth on a sketch the area boundaries within which no cutting will be allowed and specifying other recommendations in sufficient detail to be clear to the company officials (usually the woodlands manager, district and local foresters) who sign it. Copies of this document are sent to the company officials concerned and to Fish and Game Department personnel involved, and the original is kept in the Department files.

When it is known that cutting will take place in the near future, the boundary of the reserved area (nucleus of the deeryard) is marked with paint or plastic flagging. A color to delineate this line is agreed upon in advance and usually contrasts with other company boundary colors. Then when the actual cutting takes place, it is usually done by an independent "jobber," and further inspections are necessary to insure compliance with the agreement. Company foresters have little time to make the inspections so it is usually necessary for the deeryard management biologist to accomplish this part of the operation as much as possible. When the cutting is finished, the standing timber in the nucleus of the yard presents a noticeable cover type change, and sportsmen are beginning to recognize these timber reservations and the purpose for which they have been saved. One method of informing the sportsman is by the posting of painted hardboard signs which show the company's name and indicate that deeryards in this area are being cooperatively managed. The signs are posted on the company's woods roads as conspicuously as possible.

In the general area where the specific yard type of management is being used, all of the major landowners have signed the general agreements with the Department, and this embodies approximately 90 percent of the timberland in the area. This high degree of cooperation at the management level is very encouraging, and the specific yard plan approvals are also very encouraging (Table 1). The total acreage of pulpwood left standing by the companies is 1468, which at the rate

TABLE 1. DEERYARDS ACCEPTED BY TIMBER COMPANIES FOR MANAGEMENT.

Principal Owner or Manager	Deeryard Name	Town	Pulpwood Reserve Acres	Year of Cut
COE AND PINGREE	Birch Brook	Magalloway	Indef.	59-63
COE AND PINGREE/ BROWN COMPANY combined	C Pond	C Surplus	None	59
DIAMOND NATIONAL CORP.	Pond Stream	Carrying Pl.	Exp't	59
	Jerome Brook	" "	16	59-63
	Bog Brook	Dead River	10	59-63
DEAD RIVER CO.	Matt'tis Str.	3R9	24	64-65
HUDSON PULP & PAPER CO.	Cold Stream	Dallas	29	60
	Lutton Brook	Eustis	9-18	61
INTERNATIONAL PAPER CO.	N. W. I. Salmon Str.	1R6	0	59
	L. Whitten Br.	Matt'keag	15	58
PENOBSCOT DEVELOPMENT CO.	Ship Pond Str.	Willimantic	7	58
	Macwahoc #1 & 2	Macwahoc	21	63-64
	" #3	"	29	63-64
	Meadow #1 & 2	"	0	None
	Snake Br. #1-3	"	0	?
	Wytopitlock #1	Reed	16	None
	" #2	Reed	14	64
	" #3	"	11	64
	Smith Br. #1 & 1A	"	22	None
	" #2	"	None	None
	Palmer Deadwater	"	30	None
	Smith Br. #3	"	None	None
	Norton Brook	Brownville	21	None
	Wilson Stream	Willimantic	?	None
	Grindstone Pond	"	?	None
	Cook Bog	Kingsbury	48	64
SCOTT PAPER CO.	Robinson Outlet	Caratunk	47	63-64
	L. Dimmick Pond	"	10	None
	Usher Inlet	Flagstaff	20	59
	Moxie Bog	Bald Mt.	6 <sup>1</sup>	None
	Lazy Tom	1R14	20	60
	N. B. Carrying Pl.	Car. Place	12 <sup>2</sup>	62-63
	Deadwater	Mayfield	44	61
	U. Churchill Str.	Moose R.	86	61-63
	Stony Brook	Sandwich	125	None
	Tom Fletcher	Brassua	88	None
	Pierce Pd. Str.	1R3, etc.	48	62-64
	Jewett Brook	1R14	63	63
	Black Brook	Pierce Pd.	72	64-65
	Austin Stream	Mayfield	160	66
	Lucky Brook	Spencer Bay Twp	156	None
U. S. FOREST SERVICE	Wild River	Batch Gr.	NA <sup>3</sup>	—
	Broken Bridge	Albany	NA	—
S. D. WARREN CO.	Kiger Hill	Bingham	NA	63-64 (also periphery)
J. W. SEWALL CO. Agents for Huber Corp.	Indian Str. Twp.		170	None
OXFORD PAPER CO.				None
OTHER PART OWNERS (Informal Agreements):				
CENTRAL MAINE POWER CO.				
VILES TIMBERLANDS, INC.				
PHILBRICK LAND CO.				

<sup>1</sup> Plus about 25 acres of cedar.<sup>2</sup> Plus cedar acreage.<sup>3</sup> Not applicable.

of 20 cords per acre is a donation of 29,360 cords of pulpwood to the deer in Maine. While there are many more yarding areas to be preserved, about 75 percent of those in the area of present operations have been included in cooperative agreements. Some of the areas have not yet been cut, but when they are the agreements will still be observed.

The *strip method* of deeryard management is more adaptable to the northern part of the state since softwood cover constitutes a much larger percent of the area. In fact, the two major companies in this area have had a policy of reserving timber to protect stream banks and shores of lakes and ponds and along roads for several years (Carson, 1966). Others soon began to do the same. In view of this, no written agreements have appeared to be necessary. The width of the strip varies with the terrain, but in general the Department recommends a minimum width of two chains (132 ft.) on each side of the stream or lake shore. Such a strip is valuable in maintaining cover for fish as well.

After preliminary discussions were held with company management officials, the Regional Game Biologist for this part of the state made scattered field inspections of various cutting operations. The results were very gratifying (Table 2). In several cases the width of strip has been greater than 132 ft. and, while the acreage of timber reserved has not yet been computed, it is estimated to vary between ten to several hundred acres depending on the size of the pond or lake and length of stream.

TABLE 2. COVER STRIP RESERVATIONS OBSERVED IN NORTHERN MAINE

Landowner	Area	Twp.	Remarks
INTERNATIONAL PAPER CO.	Elbow Pond	T10-R11	Cover strips left around pond
" " "	Clear Lake	T10-R11	" " " " "
" " "	5th Musquacook	T10-R11	" " " " "
" " "	4th Musquacook	T10-R11	" " " " "
COE AND PINGREE	Big Goddard Bk.	T15-R5	Cover strips left for most part
PINGREE AND DUNN HEIRS	Mooseleuk Str.	T10-R9	Cover strips left on str.
GREAT NORTHERN PAPER CO.	AlPomkeag Lake	T8-R6&7	Cover strips left around pond
" " " "	Fox Brook	T13-R9	Cover strips left for most part
" " " "	Chase Brook	T13-R8	" " " " "
" " " "	White Horse Lake	T7-R7	Cover strips left
" " " "	25-Mile Stream	T12-R9	" " " "
PINGREE AND IRVING	Little Pillsbury	T8-R11	Cover strips around ponds
PULP AND PAPER LTD.	" " "	" " "	" " "
PINGREE AND PENOBSCOT	Big Pillsbury	T8-R11	Cover strips around ponds
DEV. CO.	Haymcock Lake	T5-R11 & T8-R11	Cover strips around lake
ISLAND FALLS	Sly Brook	Island Falls	Cover strips left
J. W. SEWALL CO.	Scraggley Lake	T7-R8	" " " "
" " " "	Millimagassett Lake	T7-R8	" " " "
PENOBSCOT DEV. CO.	Hay Pond	T7-R11	" " " "
" " " "	Snowshoe Pond	T7-R11	" " " "

### RESULTS

The evaluation of the results of these timber reservations has been of a general observation nature until two years ago when it was planned to obtain more specific information through automatic collaring devices. It is a frustrating fact that the two mildest winters of record occurred during the last two years, and were so mild that deer were essentially unrestricted all winter. Consequently, the current winter has afforded us the first opportunity to get collars on deer. Through the data obtained as future observations or when the deer is bagged by a hunter, and from on-the-site studies, determinations can be made of the distance deer travel from their yarding areas and consequently the distance from usual hunting areas where deeryard management would be helpful. The general observations indicated that deer were making full use of reserved yarding areas where the surrounding habitat had been cut.

The attitudes of the companies involved have been very good, so good in fact that we have difficulty in keeping up with their operations. They have come to us asking to be included in this program, and we have accepted their offers of cooperation enthusiastically.

Under Maine law the game belongs to the people of the State as a whole and the landowner does not own the exclusive right to hunt it. The landowner does have the right to post his land against trespass if damage to property or violation of privacy should occur. In wildland areas where the timber companies are operating, there is little problem of hunter access. In the vicinity of active cutting operations, companies often post signs requesting hunters to refrain from going into the area, and the sportsmen have been understanding and cooperative in this respect. Most timber company roads are open to hunters during the deer season, and most of those which are closed are located where hauling operations are in progress. These are usually narrow roads where two vehicles have difficulty passing, especially when one is a loaded 10-wheel truck.

The attitude of the sportsmen in response to this program has been very good when they have been informed of it. We feel it is necessary to keep this type of information before the public at all opportunities so that as many as possible can appreciate the efforts being made.

### FUTURE WORK

We hope that in the future we will have the opportunity to have many more deeryards preserved through timber company cooperation, and that it will be possible to evaluate the degree of cooperation and the benefit to game in all cases. It appears possible to allow a

small amount of the crown cover within the nucleus of a deeryard to be removed for commercial purposes, but a study of the effect of various percentages of crown cover removal is necessary before an operational plan can be devised.

Further studies of the movement and activities of deer will be made to determine the distance they travel from yarding areas and where their time is spent. It is hoped that automatic collars and radio telemetry and other studies will provide this information. Microclimatic studies may yet be needed to provide answers to several questions pertaining to the possible creation of new yarding areas where this appears necessary.

In all of this work we will be on commercial forest lands and we want to continue the good start that has been made in obtaining timber company cooperation.

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#### DISCUSSION

DISCUSSION LEADER CRAWFORD: Thanks, Ken Hodgdon, for a fine review of a going program of deer management in commercial forest lands in Maine.

I would like to pose one question to Ken. You made no mention of the paid hunting aspect of these commercial forests in Maine. Is there a policy of paid trespass rights or would you like to comment on this?

MR. HODGDON: There is no policy at the present for paid trespass rights in Maine on commercial forests. There has been a study started by one of the companies to determine the feasibility of this, and some actual paid access has been invoked on a trial basis. We feel that this will not go very far, I would say, in stopping hunting or even eliminating or cutting down on the hunting pressure in the area.

DISCUSSION LEADER CRAWFORD: I think your commercial interests in Maine are to be highly complimented on this program. The dollar bill evidently isn't exactly first in this case.



## SMALL WATERSHED DEVELOPMENTS IN NORTH CAROLINA

FRANK B. BARICK<sup>1</sup>

*North Carolina Wildlife Resources Commission, Raleigh*

This paper describes the adverse effects of Public Law 566 small watershed projects on wildlife resources in eastern North Carolina and outlines our efforts to preserve these resources. It is presented with the hope that it may be helpful to other states faced with this same problem.

Before reviewing this matter we should perhaps point out that we consider the protection and management of wildlife resources within a state to be the responsibility of that state, or more specifically that branch of state government having to do with wildlife resources. Regulations regarding harvest, propagation, etc., are formulated by the state and it is up to these people in state government to guard these resources against adverse influences. It is for this reason that we in the North Carolina Wildlife Resources Commission have concerned ourselves with the threat to wildlife posed by the small watersheds program.

A brief review of the history of P.L. 566 in North Carolina demonstrates that if wildlife values are to be preserved it will require continuing effort, sustained over a period of many years. While we see hopeful signs of improvement in the attitudes of drainage interests and have read plans which include project modifications to protect wildlife values, we have yet to see such modifications actually installed. Nor does our experience lead us to expect continuation of design modification in the interest of wildlife should we cease to be concerned.

The first North Carolina pilot small watershed project was initiated in the early 1950's, and it did not appear to hold any threat to wildlife. On the contrary, since it was located in the piedmont section of our state, it actually enhanced wildlife values.

Our attention was first drawn to the potential threat of P.L. 566 to wildlife about ten years later with the completion of projects in our northern coastal plain. Since we had enjoyed many years of close and harmonious working relationships with federal agencies, it was hard to believe that there had come into being a federal program which threatened the natural resources of our state. But on-the-ground inspection confirmed field reports of wholesale destruction of vast acreages of hardwood swamps which are of great importance to

<sup>1</sup>Chief, Division of Game.

wildlife throughout our coastal plain. The following illustrates what we found:

Cashie Swamp north of Windsor in Bertie County, North Carolina. This is a typical hardwood swamp which is usually full of water after a period of heavy rainfall in mid-winter. The road is high enough and the bridge wide enough so that they are seldom, if ever, under water. We are advised by forestry experts that winter flooding is essential to production of the high-quality fast-growing tupelo gum and the slower-growing cypress present. Swamps such as these serve as resting, roosting and feeding places for mallards and black ducks as well as woodies. They are escape areas for deer and wild turkey and raccoon. There is enough water to provide good fishing (pickerel, robin, bass), and trappers catch many mink and otter along the runs.

Goshen Swamp near Kenansville in Duplin County, North Carolina. This is another typical hardwood swamp. Near the edge of the swamp are large water oaks which produce acorns highly prized by practically all wildlife. Winter flooding of swamps into the zone containing oak trees is essential if waterfowl are to make use of this food. One trapper reported catching 30 otters in this swamp run.

Stubbs Veneer Mill, Windsor, North Carolina. This mill, and several others like it in eastern North Carolina are dependent upon the high-quality tupelo gum which grows in southeastern hardwood swamps. The veneer made at these mills is used in the furniture factories in the central and western parts of our state. North Carolina leads the nation in manufacture of furniture and hardwood plywood. Veneer manufacturers tell us that loss of locally produced raw materials through swamp drainage would be a serious blow to these important segments of the state's economy.

Ahoskie Creek drainage ditch in Hertford County, North Carolina. This ditch was examined in February, 1965 after a 2.3 inch rain. While the ditch was full, the swamp through which it runs was dry. Prior to ditching, this swamp looked like the ones described earlier. The excellent stands of tupelo gum on both sides of the ditch already showed signs of incipient die-back in the tops during the first year after drainage. The best timber is usually in the swamp run, but this was destroyed in clearing a 150-foot wide right of way.

Culverts placed through the spoil at swamp-floor level effectively removed all the water in the swamp since the ditch was dug through the lowest portion. The water level in the ditch even after heavy rain is about four feet *below* swamp-floor level. Prior to ditching the water would lie about four feet deep *above* the swamp floor. On the swamp side of the spoil, the rapid flow of water from the swamp into the

culvert pipe after a period of heavy rainfall is so effective that the culvert is less than one-fourth full.

At another location in the same swamp drainage project, water has eroded through the spoil and cut a channel from the swamp into the main ditch. These natural breaks in the spoil further accelerate swamp drainage and drying.

Immediately after a period of heavy rain in January, 1965, there was no water in the swamp. Similar rains in previous years, prior to ditching, would have resulted in water depths to the top of the butt swell on the larger trees. Prevention of water accumulation will, within a few years, result in the development of a dense understory of shrubs and vines and a change in forest type, which will make it untenable by waterfowl. Ingrowth of briars and honeysuckle has been accelerated by swamp drainage.

Public Law 566 and the administrative directives under which these drainage ditches are dug specify they shall not be for the purpose of creating additional farm land. A several-acre field of tobacco in the Ahoskie Creek project was planted in 1964 after ditch construction, much of it on "new land" made available by accelerated drainage. We are advised that the work plan did not reflect this increase in cropland acreage because a similar acreage on an upland site was planted to pine.

In addition to their wildlife value, undrained tupelo swamps in their natural state serve as detention reservoirs to prevent downstream flooding, and by slowing down runoff help replenish underground water supplies. After the Ahoskie drainage project was completed, groundwater monitors of the U. S. Geological Survey reported a drop of four feet in the local groundwater level. Industry and population planners tell us that water shortage constitutes the next major threat to our expanding human populations. Hardwood swamp drainage is hastening the day of confrontation with this problem.

When we first expressed concern about the destruction of wildlife habitat, reaction of representatives of the sponsoring agency ranged from disclaiming responsibility for preservation of wildlife resources to admission of error and request for cooperative solution of the problem.

One of the first suggestions for cooperation included participation in local watershed meetings to request conservation of wildlife. This proved to be basically unsound, since it placed on the state the burden of requesting mitigation as an added project expense. As anticipated, local reaction was negative. What may be an extreme example of negative local response was the refusal to allow less than three *cents*

per acre for pipes with risers to preserve hardwood swamps on a project costing several *dollars* per acre for drainage.

Another proposal for cooperation was for the wildlife biologist to suggest engineering design modifications. As might be expected, these suggestions were labelled unsound from the standpoint of engineering practicability.

These experiences indicated that protection of wildlife interests might be enhanced by finding common cause with related resources being threatened. Water conservation appeared appropriate, especially since U. S. Geological Survey records indicated a substantial drop in groundwater levels coincident with completion of early projects. But the importance of water conservation is hard to sell in an area where the initial concern is removal of water.

As I pointed out earlier, the hardwood veneer industry in eastern North Carolina is largely dependent upon raw materials growing in these swamps. Finding common cause with this segment of industry, we introduced a resolution before the local section of the Society of American Foresters calling for swamp hardwood preservation. The matter was referred to committee and a field inspection was scheduled for June of 1964. Participating in the inspection were representatives of the related state and federal agencies as well as industry.

This tour, and others which followed, underscored the broad range of values other than wildlife being threatened by unrestrained hardwood swamp drainage under P. L. 566. It also provided opportunities to discuss methods of modifying projects so as to provide flood protection on cropland without destroying hardwood swamps.

Coincident with concern for preservation of eastern Carolina swamps from draining by P. L. 566, was concern for destruction of trout streams by impoundment in the western part of the state under the same program. Wildlife interests did not oppose flood control on mountain streams. But their studies showed that permanent impoundments on these streams would warm the water to an extent that would make them uninhabitable by trout. They therefore insisted that dry dams be used to control floods as opposed to permanent ponds. Similar studies by our fisheries people indicated that ditching eastern swamp runs resulted in reductions of about 90 percent in both weight of game fish per acre and numbers of game fish exceeding six inches in length.<sup>1</sup>

In response to concern expressed in various parts of the country in

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<sup>1</sup>"The Effects of Channelization Upon the Fish Populations of Lotic Waters in Eastern North Carolina," by Jack Bayless and William B. Smith, North Carolina Wildlife Resources Commission.

regard to impact of P. L. 566, a liaison committee between the Departments of Agriculture and the Interior had been established, and this committee came to western North Carolina in October, 1965 to view the trout stream problem and to hear the hardwood swamp drainage problem. At this meeting we pointed out that the North Carolina Soil and Water Conservation Needs Inventory of 1962 indicated a total of 211 watersheds in North Carolina and need for conducting works of improvement in 208 of them. Of these, nearly half, or 101 are located in the coastal plain. Approximately five percent of coastal plain watersheds, or about 780,000 acres, are classified as wetlands. But this small percentage of the total land area constitutes nearly 54 percent of the state's total wetland Types I and VII<sup>2</sup> which are classified as being of highest values to waterfowl, deer, and wild turkey.

Thus, if no change is made in method of operation, North Carolina stands to lose over half of all her best hardwood swamp wildlife habitat to drainage programs. And we consider the projected destruction of 54 percent of a state's hardwood swamp wildlife habitats by a federal program to be a serious matter.

Let me repeat that those of us who are in state government are not opposed to federal programs. But we are *much* concerned when those programs, even if inadvertently, adversely affect the resources which we administer. As expressed in a resolution adopted by the International Association of Game, Fish and Conservation Commissioners at its meeting in Portland, Oregon, on September 21, 1965, we believe that the protection, preservation, and mitigation for fish and wildlife losses resulting from P. L. 566 projects should be made part of the project responsibility, included as condition of project approval, and financed entirely with federal funds.

As of now, March, 1966, we find that the number of P. L. 566 projects in North Carolina continues to increase, but there are signs of hope in our struggle to save our wildlife. There are now 74 P. L. 566 projects in various stages of planning or construction, including 43 in the coastal plain. Three of these projects have been completed in the coastal plain.

Much of the credit for the hope on the horizon goes to the top administrators of the Soil Conservation Service in our state, Mr. Joe Kuykendall, State Conservationist, and Mr. Elmer Graham, his assistant in charge of watersheds. They have indicated a desire to work with us and we are now finding their concern for preservation of wildlife values reflected at the field and planning levels. We find

<sup>2</sup>As classified in "Wetlands of the United States," Circular 39, U.S. Fish and Wildlife Service, 1956.

indications that provisions for preservation of wildlife are being included in the original basic project design rather than as an add-on supplemental cost feature. We are also finding indications that the local work unit conservationists are pointing up wildlife values in the course of initial discussions with local people who are considering initiation of drainage programs.

Among other examples of reason for hope, we may list the recently completed Chicod Creek project work plan (yet to be approved by Congress) which contains a total of 1,767 acres of wetlands. This work plan provides for a 12-acre fish impoundment, and 60 acres of swamp preservation by spoil placement and water control pipes.

The Little Contentnea Creek project work plan, about to be endorsed by the local sponsors, contains a total of 5,539 acres of wetlands. This work plan provides mitigation in the form of 75 acres of fish ponds and 270 acres of wetland preservation by spoil and water control structures. The design calls for coring the spoil so as to reduce water loss by seepage from the swamp into the ditch.

The Hobbsville-Sunbury project, currently in the review stage, includes 2,534 acres of wetlands. This plan calls for about 200 acres of wetland preservation with *cored* spoil *and* control structures *and* with provision for maintenance and operation of control structures by local sponsors.

These projects call for progressively increasing proportions of the original wetland habitat to be preserved with increasing effectiveness. In developing these plans our working arrangements call for identification of important swamp areas by Wildlife Resources Commission biologists with suggestions for methods of preservation.

There are other reasons for hope. We find, for example, that the Soil Conservation Service drainage engineer for the South Atlantic Coast States, in a paper before the March, 1965 meeting of the American Society of Civil Engineers in Mobile, Alabama, recognizes the value of hardwood swamps and suggests methods of preserving them in the course of developing forest drainage systems. This paper lists several practices which can be appropriately used, including "continuous spoil dikes with pipe drains to control outflow, floodways without main channels, or control structures in the main channels. In some instance, it may be sufficient to consider only the omission of secondary ditches or simply the use of the existing flood plain and swamp runs without any improvement."

Fulfilling suggestions in his paper, Mr. Schlaudt has prepared a guide for Soil Conservation Service design engineers entitled "Water Management on Wet Forest Sites for Timber Production." We are now hopefully awaiting implementation of these new designs in

future projects, and trust also that they will be used to preserve still larger portions of valuable wetlands.

Conversation with representatives of at least two North Carolina industrial foresters indicates that water level control, as opposed to drainage, has been practiced for several years. This experience indicates that channel blocks can be used effectively and need not result in excessive sedimentation.

Another hopeful sign is the continuing research in regard to hardwood swamp management as reviewed by Ralph Klawitter, project leader with the Southeastern Forest Experiment Station in the July-August, 1965, issue of the *Journal of Soil and Water Conservation*.

While we should like to end this paper on this highly optimistic note, a few recent developments indicate that it would be premature to consider the struggle won.

Two almost simultaneous statements from the U. S. Department of Agriculture provide cause for concern. One statement by Mr. Godfrey (Federal Administrator of the Agricultural Stabilization and Conservation Service) in January called for a reduction in drainage projects under the ASCS program. This was followed by a statement by Secretary Freeman reporting substantial expansion of the small watershed program. It is our understanding that drainage under ASCS is largely limited to cropland improvement on individual farms. If this is to be curtailed in favor of the broader watershed approach, it may bode ill for wetland wildlife. If, on the other hand, the proper accent is placed on planning, as emphasized by Mr. Freeman, to the extent that lands are zoned and naturally wet areas are preserved as reservoir sites, we might continue to hope for the future. If, however, we undertake to feed the rest of the world, we will probably run ourselves out of water as well as wildlife long before accomplishing that noble but futile goal.

Two other federal programs justify continued scrutiny as they may affect wetland wildlife. One is the rumored intrusion of TVA into a program of trout stream impoundment, and the other is the expansion of Corps of Engineers Section 205 flood control projects. Five such Corps projects are now underway or completed, and 25 are in the pre-authorized study stage. Some of these hold the same potential threat to wetland wildlife as P. L. 566. There is one difference, however, in that the Corps of Engineers is subject to the Fish and Wildlife Coordination Act, which insures recognition of wildlife values in federally sponsored projects. Inclusion of TVA and P. L. 566 projects under the same act would be a strong step forward for wildlife interests.

In conclusion and summary we make the following points :

1. Protection and management of wildlife resources are functions of state government and identification of potentially significant damage to a state's wildlife resources is the responsibility of the state agency having legal jurisdiction over these resources.

2. Securing recognition of wildlife values may require finding common cause with other resources being threatened.

3. Any project established by federal subsidy should also include federal funds for the protection of the wildlife resources endangered by that project.

4. Development of project design to provide for protection of the state's wildlife resources is the responsibility of the sponsoring federal agency. The state wildlife agency may help guide project design by describing the physical conditions necessary to sustain the wildlife values threatened.

We would like to feel that this approach will insure preservation of wildlife values. And there is at the moment justification for this feeling. If such proves to be the case there would be no reason to press for congressional limitation of funds and other similar moves which have been suggested.

DISCUSSION LEADER CRAWFORD: Thanks, Frank Barick, for your usual good presentation.

I think it is very apropos that the attention of our group is again focused on the need to properly implement Public Law 566. Evidently, the magnitude of these watershed programs is just dawning on many people and the many interests that are involved in them.

This is a problem that was recently called to my attention. I attended a wood duck symposium in Lansing, Michigan in December. We had a waterfowl representative from the Southeastern United States who more or less summed up the whole problem of wood ducks in relation to watershed programs, and it was certainly a very dark outlook for the future as far as the wood duck was concerned.

Just a comment, and I will end it. From where I sit, it seems that for the benefit of the state fish and game departments and the federal agencies, a great amount of time would be saved if we could put a national policy to use here instead of having to hammer and trash this thing out state by state.

I think there is a great amount of effort going on across the landscape in each state to accomplish this. I am sure this certainly could be helped by a more general approach to the whole problem.

If there are no problems from the floor, we will turn this back to Fred.

CHAIRMAN STANBERRY: Thank you, Bill, and we will continue with the next paper on the same subject, the Public Law 566 Program.



## WILDLIFE MITIGATION MEASURES IN THE NORTH DAKOTA WATERSHED PROGRAM

ROBERT L. MORGAN

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Watershed activity in North Dakota started with authorization of the Tongue River Pilot Watershed in July of 1956. This 295,000-acre watershed project, with its 10 dams and 48 miles of channel, was the beginning of a new era in the field of wildlife habitat loss, preservation, and development.

Status of the watershed program in our state has evolved from this one project to the following magnitude (October 20, 1965) :

Completed Project	1	295,000 acres
Projects Under Construction	10	1,610,659 acres
Projects with Structural Measures Completed	1	30,220 acres
Projects Being Planned	10	1,456,065 acres
Project Applications Pending	22	<u>3,047,402 acres</u>
Total	44	6,439,346 acres

The 12 projects listed above, as completed, under construction, or with structural measures completed, contain plans for 35 reservoirs and 443.5 miles of channel work. This averages out to about 3 reservoirs and 37 miles of channel work per project.

Minimum channel work planned for one of the 12 projects is 3.7 miles. Maximum channel work planned for one of the 12 projects is 120 miles. Some 175 miles of channel work has been completed in North Dakota watershed projects as of October 20, 1965.

The emphasis is placed on the construction phases of the watershed program in this paper, for herein lies the greatest problem area from the wildlife habitat standpoint. No one can construct a reservoir or channel without disrupting the ecology of the area to some degree. It is the measurement of this degree of disruption and measures to mitigate or compensate for same that chiefly concern wildlife people in today's watershed program.

### EARLY PROBLEMS

The first three or four watershed projects in the state slipped by the planning stage almost unnoticed by our department. Some attention was focused for a short time on potential fishery reservoirs, but the original policy of cost sharing on same was rather unattractive. Thus, early in the game, we assumed a general attitude of indifference to the whole matter of the watershed program.

It was not until actual construction was practically completed on

channel work in a watershed with a fair wetland complex that we became fully aware of the damage that could result to wildlife habitat from this program. With the awareness of possible damage came the first problems.

In order to solve this problem of damage to wildlife habitat, we first had to understand the program causing the damage. And in the early stages of the watershed program, policy changes were being made at frequent intervals.

Having wrestled with the problem of understanding a new program, our next problem was one of communication. This should have been relatively simple, except that we were trained biologists talking to trained engineers, and the planning party was located in a city 200 miles distant from the state SCS office and our office.

To further complicate the problem, bear in mind that some of the engineers had "cut their teeth" on drainage of water. It became painfully apparent that the planning party consisted of many specialists, but none was technically skilled in the specialty of wildlife management. And we certainly weren't skilled in the specialty of engineering.

Having finally cracked somewhat through this barrier of communication, we immediately ran into another problem. Our "too smart" observations and recommendations were getting into the planning stage "too late." We were becoming an unwelcomed nuisance to the planning party and the state SCS people. Many of our proposals were so late that they created amendment or supplementary problems to specific watershed plans. Why "so smart, so late"? Lateness in getting into the planning stage: We weren't *working with* SCS to plan the project, we were commenting on what *they had finally planned*.

Having solved this problem, we came to another . . . to measure the degree of disruption the proposed plan would have on the ecology of the area and propose ways and means to mitigate or compensate for this degree of disruption that were both feasible and practical.

The final problem was agreement on mitigation measures for inclusion into the work plan and acceptance by the local sponsors of the work plan with included mitigation measures. This last part loomed as a big problem, as mitigation measures must be paid for by P.L. 566 funds and the local sponsors of the project.

#### HOW SOME OF THE PROBLEMS WERE SOLVED

Understanding the watershed program, with all its policies and ramifications, was achieved to a workable degree by discussing the program with key personnel in the Soil Conservation Service and the

Missouri River Basin Office of the Bureau of Sport Fisheries and Wildlife.

The communication problem between biologists of the wildlife agencies and engineers, hydrologist, etc. of the SCS was solved in our case by assigning the SCS biologist to "watershed planning party status." The SCS biologist was directed to act as liaison between SCS and the wildlife agencies.

The communication problem within SCS (between the state SCS office and the SCS Watershed Planning Party) was solved by moving the planning party office 200 miles west into the state SCS office. This, of course, also greatly eased the communication and coordination problems between wildlife agencies and SCS.

The final gap in the communication and coordination system was bridged by establishing a monthly interagency watershed projects' meeting. Personnel attendance at the meetings varies from agency heads and field personnel to meetings between staff personnel, depending on the nature of the business to be handled. Minimum make-up of the meeting personnel includes the watershed planning party leader, the SCS biologist, a representative from BSWF, and a representative from the Game and Fish Department.

Projects are reviewed at each meeting. All agencies are allowed to ask any question necessary or make any statement thought to be in the best interest of the coordinated program. The SCS biologist acts as secretary, and minutes of the meeting are later sent to all agencies involved. The meetings are strictly informal and could best be classed as informational or coordinating type meetings.

From the monthly interagency watershed meeting evolved solutions to the other problems.

Discussion in the first interagency watershed meetings brought out the fact that comments and recommendations from the wildlife people were desirable earlier in the planning stage to avoid design and other changes. The solution was simple—SCS would bring in the wildlife agencies at the earliest possible stage of planning. The reviews and recommendations are now a part of the early watershed planning. Instead of commenting on the work plan, our findings and recommendations are now coordinated into the first-draft watershed work plan.

To solve the problem of measuring the degree of disruption the proposed plan would have on the ecology of the area, wildlife biologists from SCS, BSWF, and GFD make a field review early in the initial stage of planning. A joint report on same is then made available to the SCS watershed planning party. The field review by the wildlife specialists concentrates on areas of construction-reservoir sites and channel work areas. General census work conducted by the

wildlife agencies and any special census data gathered is used to supplement the wildlife field review. This joint report points out areas of potential habitat loss, enhancement, and mitigation measures to compensate for losses in the specific watershed plan.

Solving all of the aforementioned problems only really led us down a one-way street to the main problem—mitigation of wildlife habitat losses. It is nice to coordinate activities, make field trips, write up specific recommendations, etc., but it is really all quite expensive and meaningless unless the measures recommended to compensate for wildlife habitat loss become a part of the final accepted watershed plan.

Our field reviews and joint reports brought out areas of habitat loss that could not be avoided if the project was to be built. The only way possible to have flood control and benefit soil and water resources without destroying a wildlife resource was to mitigate for wildlife habitat losses. When this became apparent to all agencies involved, SCS agreed to work mitigation measures into the watershed work plan and present this plan to the local sponsors. SCS also agreed to explain to local watershed sponsors at the initial meeting with them that mitigation of wildlife habitat losses was a distinct possibility.

Four groups of local sponsors have agreed to mitigation measures for wildlife habitat losses in the last four successive work plans and supplements. I believe the credit for this success deals directly with the attitude and policy of the North Dakota SCS people. As the draft watershed work plan is being developed, the SCS spokesman presents the proposed mitigation measures as an integral part of the over-all plan. The local sponsors are informed that the mitigation measures are recommended by SCS and concurred in by the Game Department and BSWF. During the planning process, the local sponsors are informed by SCS that suitable mitigation measures *must* be included in the final work plan.

#### MITIGATION MEASURES

“Mitigate” means to make less severe or harsh—to temper. Thus, what we are attempting to do is mitigate or make less severe the loss of wildlife habitat that could occur from a specific watershed project.

To “make less severe” is in itself a phrase to compromise. Our goal in determining mitigation is set at compensation for these habitat losses. To what degree we are achieving this goal is strictly a matter of judgment. We have hopes that an evaluation study, presently in the discussion stage, will give us some answers needed on several phases of mitigation we are presently employing to compensate for wetland losses.

Mitigation is based on replacing like for like. Deer habitat is not replaced by better fisheries or waterfowl habitat, etc. We have attempted to stay away from "gray" areas that could be classified as "nit-picking" zones.

As previously stated, we believe that the success or lack of success of a mitigation proposal lies directly with how it is presented to the local sponsors by SCS. If it is part of the over-all plan, chances for acceptance of the proposals are excellent. If however, the mitigation proposal is presented as a side issue, it will have very little chance to be accepted by the local sponsors.

The word "mitigation" was not mentioned in our early work on watershed projects. Enhancement features offered the first opportunity for coordinated effort. When it became apparent that mitigation measures were definitely needed on several projects before the wildlife agencies could concur, the word "mitigation" became a part of our discussions regarding watersheds.

The first attempt to mitigate wildlife habitat losses occurred the summer of 1964 on the third supplement to the Wild Rice Creek Watershed Work Plan. This supplement involved rehabilitating 6.09 miles of an existing old legal drain ditch known as channel #9. A letter of concurrence on these mitigation measures was written by Commissioner Stuart on December 30, 1964.

Mitigation measures proposed for the four watershed work plans and supplements mitigated in North Dakota to date are as follows:

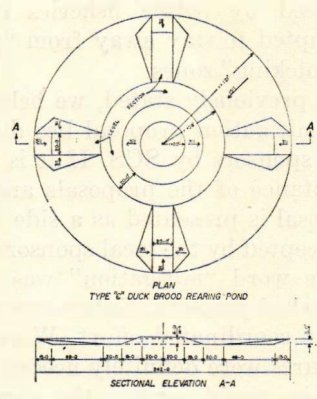
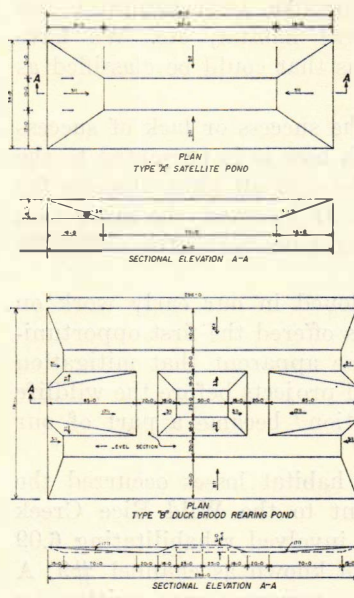
#### *Supplement 3 to Wild Rice Creek Watershed Work Plan*

Originally, it was proposed to develop a 25-acre marsh to mitigate wetland losses that were expected to occur by improving the 6 miles of channel. Development of this proposed marsh was found to be infeasible because of topography.

As an alternate plan, development of seven one-acre ponds and 18 smaller satellite ponds to serve as waterfowl production areas was proposed (Figures 1 and 2).

The one-acre brood ponds are of two designs. The circular design calls for a minimum excavation of 4800 cubic yards of dirt. The rectangular design requires a minimum excavation of 6300 cubic yards of dirt. Each will have approximately one surface acre of aquatic habitat with a nesting and loafing island in the center. Maximum depth will be five feet. Cost of these seven brood areas is expected to run about \$1200.00 each. Choice of design was left up to the local landowner and the local sponsors. Present plans call for six rectangular types and one circular.

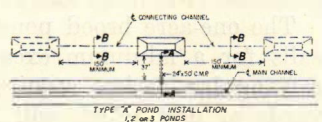
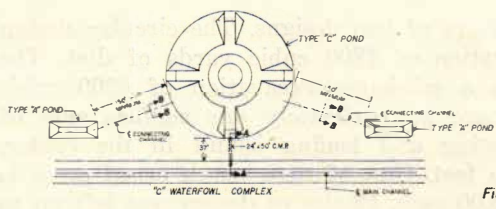
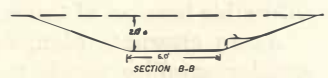
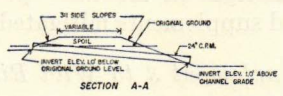
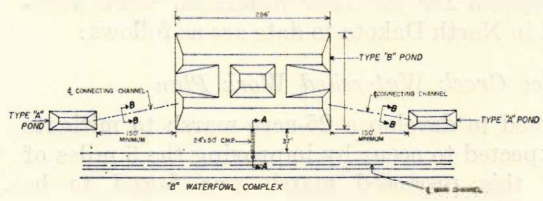
The 18 satellite ponds will be 91 feet long and 34 feet wide, with a



POND TYPE	CU. YDS.
A	370
B	6,302
C	4,812

DETAILS OF DUCK PONDS  
CHANNEL #9  
WILD RICE CREEK WATERSHED  
SARGENT COUNTY-NORTH DAKOTA  
U.S.D.A. S.C.S.

Figure 1



DETAILS OF DUCK PONDS  
CHANNEL #9  
WILD RICE CREEK WATERSHED  
SARGENT COUNTY-NORTH DAKOTA  
U.S.D.A. S.C.S.

Figure 2

maximum depth of six feet. Approximately 370 cubic yards will be removed to make each satellite. No more than 3 satellites will be attached to one brood pond. Channels will connect the satellites with the brood pond. Satellites will be at least 150 feet from the brood pond.

These artificial wetland complexes will be built in natural low areas adjacent to the channel. Source of water will be from run-off and for some ponds water will come from Channel #9 during extremely high flows.

The 50-year easements needed to construct, maintain and manage the areas have been picked up by the local sponsors from the landowners. Construction will begin on this project this summer.

### *Boundary Creek Watershed*

This 152,960 acre watershed in north-central North Dakota contains plans for one multi-purpose pool, one floodwater structure, and 65.35 linear miles of channel work.

Effect of the project on waterfowl production without mitigation was estimated at an annual production loss of some 1700 ducks. Waterfowl and Hungarian partridge habitat loss was felt to be the key mitigation item.

Mitigation measures provide for development of 53 oxbows, 41 brood ponds, 107 satellite ponds, and 5 dugouts.

The 53 oxbows in the old creek channel would be developed by diking each end, so that the maximum depth of water possible in each situation will be maintained. Average size will be 250 feet by 30 feet. Where natural run-off water is deemed not adequate to maintain a pool in the oxbow, an inlet pipe with flap-gate control will be provided.

The 41 artificial brood rearing ponds would be either rectangular or circular (Figure 1). The 107 satellite ponds will be 91 feet x 34 feet (Figure 1). The five dugouts will be about 70 feet by 160 feet, with at least half of the shoreline fenced.

The spoil from all ponds, satellites, and dugouts will be leveled and seeded to increase their attractiveness to waterfowl and partridge. A perimeter two rods wide around each of the wildlife developments, will be protected from cultivation so as to enhance nesting cover, etc.

These mitigation measures are designed to produce annually some 1600 ducks, or some 90 percent of the expected waterfowl production loss, *if* production in the mitigation developments equals our estimates.

The local sponsors approved the watershed work plan.

*Middle Branch - Park River Watershed.*

This 105,600-acre watershed plan includes five floodwater retarding structures, one wetland enhancement area, 37.6 miles of channel work, and 19 miles of snagging and clearing.

Some 224 acres of woody habitat valuable to white-tailed deer and ruffed grouse will be destroyed by construction of the floodwater retarding reservoirs. Another 208 acres of woody cover along the Park River will be destroyed by channel work. Waterfowl and furbearer habitat will be destroyed by the channel work on the Park River, as well as key deer wintering areas and other game habitat.

Mitigation measures proposed include acquisition by local sponsors of 305 acres of timber adjoining and in addition to the sediment pools of the five structures. These areas will be protected by fencing.

In the channel area, 13 oxbow areas and adjacent woods will be acquired by local sponsors. All oxbows will be blocked at both ends and pipes installed to permit maintenance of water about 4 to 6 feet deep. These oxbow areas will total about 118 acres. Protection of areas from grazing, human habitation, etc. will be required.

An additional area of about 140 acres of woody habitat will be developed or preserved in the channel work area by acquiring adjacent woody lands, planting of spoil areas with shrubs valuable as deer browse, planting adjacent lands to shrubs and trees, etc. These lands may be acquired through either fee title acquisition or a 50-year easement by the local sponsors. These areas will be protected by fencing where necessary.

The mitigation measures are designed to nearly compensate for the wildlife habitat losses, if our estimates of their value are correct and development and maintenance of same are carried out as planned.

The watershed work plan has been approved by the local sponsors.

*Supplement to Lower Forest River Watershed.*

This supplement adds 3.78 miles of channel improvement to the Lower Forest River Watershed Work Plan.

Several marshy bends in the natural channel will be cut off by the channel work proposed. Waterfowl and furbearer habitat would be mainly destroyed by the project.

To mitigate the wetland loss, we proposed development of a 16-acre marsh area. The local sponsors acquired 21 acres to furnish their share of the land needed for the wetland development. This land will be turned over to the Bureau of Sport Fisheries and Wildlife for management. BSWF wetland acquisition personnel are now acquiring additional adjacent land. A 120-acre marsh will now be developed.



BSFW will manage the unit as a wetland production and public hunting area.

A dike, level ditching, and necessary inlet and outlet control structures deemed necessary to develop the smaller 16-acre marsh will now be installed to maintain optimum water levels in the larger 120-acre marsh. The marsh will be developed when the adjacent channel is constructed.

This is truly a cooperative project to compensate for habitat loss. It is a rare example of combining a mitigation proposal with the enhancement possibility to develop a potential wildlife area to its fullest extent. We congratulate the local people of Walsh County, SCS, and the BSFW for this project feature.

#### SUMMATION

The solution to wildlife habitat mitigation problems in watershed projects is difficult but possible, if all agencies involved cooperate.

Understanding, communication, and scheduled meetings among all agencies and groups involved are good beginnings to solve wildlife habitat problems related to watershed projects.

Early scheduling of joint wildlife field reviews and reports in the watershed planning is not only desirable but necessary, if coordinated watershed planning is to be achieved.

As it is not feasible, practical, or morally correct to spend public funds to benefit one natural resource at the expense of another natural resource, mitigation of wildlife habitat losses should be conscientiously applied and carried out in the watershed program.

Mitigation measures should be incorporated as a part of the Watershed Work Plan, and not presented to local sponsors as an *extra* proposal of the wildlife people.

We have achieved a satisfactory degree of success in mitigating wildlife habitat losses in current watershed projects in North Dakota. Much of the credit for this success is due largely to the attitude and policies of SCS in North Dakota.

#### DISCUSSION

DISCUSSION LEADER CRAWFORD: Thank you for a constructive approach to this problem of mitigation. You know, it is nice to have a little success to report once in a while. We have many papers given at our conferences on problems, but evidently we have some success to report on here. At least to my way of thinking, perhaps the amount of time that has been devoted by the North Dakota Fish and Game Department may reflect to a pretty good degree the success of the current program they have under operation.

MR. CY KABAT (Wisconsin): It is gratifying to hear this kind of success. I hope it continues, but we have worked in a similar direction with highly formalized agreements. We appointed a watershed coordinator to work with the 566

watersheds to organize the liaison in every county. Things seemed to be going fairly well for some years, but at the present time we would say they are dreadful.

It appears that the watershed party is determined to make plans, present them to the local sponsors for recommendations on wildlife aspects, and then the department is put in the position of being against the program. It appears now that this is almost a fanatical approach with the feeling that if there is any opposition to the project and some type of mitigation is involved, that it is just too complicated and is not practical. So from an era of seemingly successful pursuits, we are now in a position where we seem constantly to have to be against the local sponsor's program.

Perhaps North Dakota's efforts are so overwhelming that you will continue to make progress. We are rather discouraged at the present time.

Perhaps the nature of the watersheds are different, but I don't think too greatly so. Our watershed is a trout problem more often than one that would affect waterfowl resources. But the problem is far from being solved, and, instead of improving, it is going the other direction.

Now what the solution is, we are not sure. We feel now that unless we can anticipate a watershed, prepare plans before they are even prepared by SCS, and introduce those to the local sponsors, we will have difficulty.

All I can say, I wish North Dakota success and that it keeps hammering away. Perhaps a success here and there will help the over-all picture because it can be used then as an example of what should be done. But it is never pleasant to have to get up and report problems, but this is a development which we had hoped to remove. But instead of being removed, it is emerging stronger than ever, and it appears that all of the fine programs that are now being instituted, and I'm sure you are all familiar with the proposed program for comprehensive planning in the Community Planning Act of 1965, will complicate the problem further because they had a staff and funds for the preparation of plans for many more watersheds and a greatly accelerated program in the making. Conservation departments will have to add staff and programs to keep up with this. It is something we really hadn't counted on.

DISCUSSION LEADER CRAWFORD: Thank you very much for your comments. Are there any others who would care to make statements?

MR. RUSSELL STUART (North Dakota): Bill, I would like to make one comment, and that is that too often we become content or complacent and speak primarily to ourselves, and meet with wildlife people only. There is one national organization that I would encourage as many state directors to attend as possible, and that is the National Watershed Congress.

I had the pleasure and the opportunity to appear on the program of the National Watershed Congress last April in Sioux City, Iowa, and I think that if more fish and game people would do that, that it would be easier as time goes by to implement the things that are necessary to make these small watershed projects of benefit to wildlife.

DISCUSSION LEADER CRAWFORD: Thank you. Are there any other comments from the floor?

MR. STUART P. DAVEY (Bureau of Sport Fisheries and Wildlife): I speak only because I happen to be a member of the Joint Committee of the ASC. First of all, I would like to second what Mr. Stuart just said. I would also like to commend both authors this morning for their papers.

One thing that always discourages me a little is not to hear the word "enhancement" mentioned more often than it is. I believe the answers, though, to this problem lie in several points of commitment, and I should like to repeat those. First of all, there is certainly communications. This has caused innumerable problems in the program.

Let's talk to each other at the state level. Early planning. This is an absolute necessity, and I don't believe you will have any trouble with this if you become involved early in the planning.

We hope that there will be more joint biologists that will report to this group.

This is the state biologists, our biologists and the council and the ASC biologists. This is not as far along as we would like to see it. Perhaps there can be a definite joint report submitted by all concerned.

Mitigation, of course, is a necessity in many cases. Let's not forget there are many, many opportunities for enhancement. What I am getting at is: let's evaluate our attitudes on the whole program.

I tend to think that there has been much wishful thinking on the part of the wildlife people. The policy is the nationwide policy. Some have expressed the thought that this should not be fought state by state. Here again, I think this is wishful thinking. There have been policies on record since 1959 on soil conservation programs regarding what they will do and what they won't do.

We have been making recommendations for years, but what someone says in Washington and what someone actually does in a certain county in North Dakota depends upon people and how they get along with each other in deals.

My point is that policies and the law are on the books. Let's get together in the field and continue to push on behalf of the fish and wildlife, and I don't believe you will have as much trouble as you think. Thank you.

DISCUSSION LEADER CRAWFORD: Thank you, Sir. Are there any other comments?

We have pretty well thrashed around the watershed program this morning. I think we have made some excellent contributions, and perhaps we can put some of this information into idealism and practicality together and move ahead a little. Thank you.

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## PUBLIC HUNTING AS A GAME MANAGEMENT TOOL IN SOUTHEASTERN NEW YORK

WARREN H. MCKEON, WILLIAM F. HOLLISTER, and MICHAEL RODAK  
*New York State Conservation Department, Poughkeepsie*

Hunting opportunity in the vicinity of metropolitan areas is usually at a premium. Urbanization, road networks, commercialization and posting, much of it attributable to intolerable hunter concentrations, are some of the factors which combine to create a block between hunters and a huntable resource. Of these, posting is the only transitory factor that can be influenced by negotiation between hunter and landowner. Landowner opinion makes the difference between hunter access or denial to game on lands that are posted.

The history of controlled public hunting in Putnam County dates back to 1939 when this site was first established as a landowner-sportsman hunting area. At that time, land utilization and economic pressures from the Metropolitan Area of New York City were not as heavy as they have become in recent years. However, it was recognized even during that period that a program to encourage landowners to open their lands to the public for hunting and fishing was essential. Thus it was that the Division of Fish and Game in 1939 negotiated with local landowners to open approximately 12,000 acres on lands located about four miles north of Brewster, New York. Beginning with the hunting season of 1939, the area remained in

operation until 1943 when, due to personnel and financial shortages, it was forced to suspend operations.

In 1957, the New York State Legislature passed an act authorizing the Division of Fish and Game to attempt to open to public hunting and fishing additional private lands and waters throughout the state under the Fish and Wildlife Management Act. This act took effect on April 1, 1958. Under the F.W.M.A., the state was originally divided into 13 districts, later modified into 9 regions for fish and wildlife purposes. The District Fish and Wildlife Management Board for Putnam, Dutchess, Westchester, and Columbia Counties was then designated District 13. Each Board is composed of one representative each of the organized sportsmen, landowners, and the Board of Supervisors from each county in the District. Each representative was to give weight to the objectives of the group he represented. The fundamental purpose of the Board was to promulgate ideas and programs to the Department for action if they seemed feasible. Thus, there were 12 voting members on the District 13 Board. In addition, there are advisory non-voting members comprised of chairmen of the Forest Practice Act Districts and the County Soil Conservation Districts in the F.W.M.A. District. This Board began meeting in late 1958. In early 1959 the Board requested the Department to take inventory of public hunting and fishing needs in the District. Among the ideas suggested by the board members to promote more and better public hunting and fishing opportunities were: 1. Delineating present state-owned lands in Forest Preserve areas; 2. The opening of state park and other quasi-public lands to hunting; and 3. The establishment of cooperative public hunting areas through agreements with private landowners.

The first project was accomplished with the cooperation of the local District Director of Lands and Forests. The Forest Preserve lands in most instances occupy the mountain slopes and tops, while road frontage in the valleys is generally privately owned. Since these valleys were usually posted against public hunting, access to this vast resource was a problem. Where Forest Preserve Lands bordered roads, signs were posted denoting Forest Preserve, public hunting and fishing. A map showing road access points was printed and made available to the public (Figure 1).

On the second project progress has not been encouraging although future prospects look brighter.

The third area in which the Board attempted to increase the amount of public hunting and fishing opportunity in the Region was through the use of cooperative agreements with private landowners

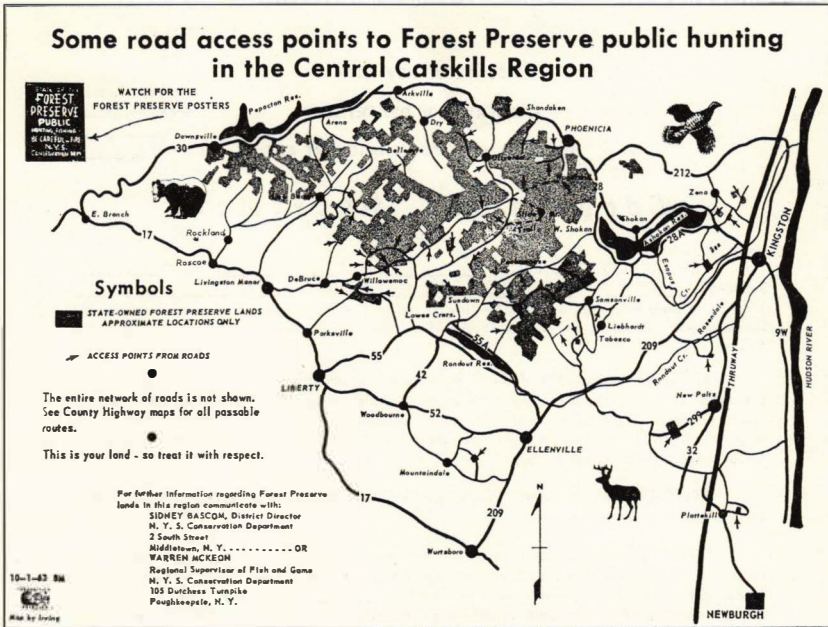


Figure 1.

(Figure 2). This was accomplished by establishing two basic types of cooperative areas under the Fish and Wildlife Management Act.

The first type was the controlled public hunting area typified by the Putnam County Cooperative Area which we shall discuss in detail later in the paper. The second was termed the "scatter-shot type area" because of the random pattern of private holdings participating.

At present throughout Region 8 (Dutchess, Putnam, Westchester, Ulster, Orange, Rockland and Sullivan counties), there are two controlled and three scattershot areas with a total of 37,000 acres. These five areas accommodate an estimated 20,000 to 25,000 hunters annually. The scatter-shot areas are not controlled, although they do have intensive special patrols during peak periods of the hunting season.

Lands signed under this type of program are posted by the Conservation Department with "Safety Zones" around farmstead areas. All cooperators receive other benefits, such as technical services, planting stock, wildlife habitat improvement and a subscription to the New York *State Conservationist*.

FWMA - 101  
4-1-58

STATE OF NEW YORK  
CONSERVATION DEPARTMENT  
FISH AND WILDLIFE MANAGEMENT ACT

Cooperator No. \_\_\_\_\_  
Project No. \_\_\_\_\_  
Acres \_\_\_\_\_  
District \_\_\_\_\_

### Cooperative Agreement

THIS AGREEMENT made this \_\_\_\_\_ day of \_\_\_\_\_ A. D. 19 \_\_\_\_\_, between \_\_\_\_\_ residing at \_\_\_\_\_ his, her or their heirs and assigns, hereinafter called the "Cooperator"; and the Conservation Commissioner of the State of New York through his representatives hereinafter called the "Commissioner".

WHEREAS, Section 198 of the Conservation Law authorizes a cooperative program between the Commissioner and private landowners for the purpose of establishing on privately owned or leased lands management practices to maintain and improve the fish and wildlife resources while safeguarding the rights and interests of landowners and improving hunting and fishing opportunities for the public;

WHEREAS, the Cooperator represents that he is the owner of the lands referred to in this agreement;

NOW, THEREFORE, this Cooperative Agreement witnesseth that the Cooperator in consideration of the conditions herein set forth and the mutual advantages derived therefrom, does hereby grant to the Commissioner for a period of \_\_\_\_\_ years (not less than 5 years) from the date hereof, all the hunting, fishing and trapping rights, unless the latter is hereinafter specifically reserved, in, to and upon all that certain tract of land situated in the Township of \_\_\_\_\_ County of \_\_\_\_\_ and the State of New York, containing \_\_\_\_\_ acres more or less, and bounded and described as indicated on the map or description attached hereto and made a part hereof.

IT IS MUTUALLY AGREED THAT:

1. Technical Services. The Commissioner shall furnish to cooperators technical services as may be required to prepare a management plan for the improvement of fish and wildlife habitat in compliance with practices approved by the district board and authorized by the Commissioner. Labor and materials, as may be required, to complete developments in accordance with the management plan, may also be furnished by the Commissioner, however, fencing, posters and other reusable materials so provided shall remain in the ownership of the State. No management practices will be established on the lands referred to in this agreement unless agreeable to both parties.
2. Planting Stock. The Commissioner shall furnish to the Cooperator trees and shrubs from any of the nurseries operated by the Conservation Department, without charge at the nursery, to the extent designated in the management plan mentioned hereinabove.
3. Subscription. The Commissioner shall furnish without charge a subscription to the New York State Conservationist magazine for the duration of this agreement.
4. Safety Zones. The Commissioner may, unless the Cooperator does not desire it, mark the boundary of Safety Zones by posting notices approximately 500 feet from buildings on said tract, warning that it is unlawful to discharge a firearm or to hunt or chase any wild animal or bird within said Safety Zone, without the consent of the Cooperator. Such posting will not prevent the Cooperator, his family, employees and guests from hunting in the area. In accordance with Section 176 of the Conservation Law additional restricted areas may be established for the further protection of life, agricultural or forest crops and other property.

5. Protection. The Commissioner may furnish protection to said tract through patrol by game protectors, special game protectors or forest rangers, within limits of funds and available manpower, as may be advisable to protect fish and wildlife resources, provide for public safety and protect rights and interests of the Cooperator.

6. Land Use. Nothing contained herein shall prevent or hinder the Cooperator from carrying out regular activities on the lands covered by this agreement, excepting those activities which would be detrimental to the maintenance of practices under this agreement.

7. Right of Entry. The Commissioner, or his representative, shall have the right of entry upon said lands at all times for the purpose of managing the fish and wildlife resources and and protecting property as provided for in this agreement.

8. Public Use. Any part or parts of said lands not set apart as Restricted Areas or Safety Zones shall remain open to public hunting, fishing and trapping, unless the latter is hereinafter reserved. The Cooperator shall not charge a fee or rental for the privilege of hunting, fishing or trapping on lands covered by this agreement.

9. Liability. This agreement shall not be deemed to constitute an undertaking by the State or the Department on its behalf to furnish such posting patrol or protection and neither such agreement nor any provision of the Fish and Game Law shall be deemed to create a ground of liability of the State for damage to person or property caused by the failure or neglect of the State or its agents, officers, or employees to furnish such posting, patrol, or protection.

10. Reservations.

11. Cancellation. This agreement may be terminated by the Commissioner upon sixty (60) days written notice to the Cooperator (a) when in the judgement of the Commissioner the land is no longer needed or desired for the purposes of the agreement or (b) when in the judgement of the Commissioner the Cooperator fails to satisfactorily perform this agreement. The Cooperator may terminate this agreement upon sixty (60) days written notice to the Commissioner. In the event this agreement is terminated, the Commissioner may, within the said sixty (60) day period, remove fencing, signs, and other reusable materials provided to the Cooperator under this agreement.

12. Renewal. If the Commissioner shall without written objection from the Cooperator hold over after the expiration of the period of time herein specified, it shall be deemed to be a renewal of this agreement for the further period of one year, and so on from year to year until either party shall give sixty (60) days previous notice in writing to the other of an intention to terminate the agreement.

Cooperator \_\_\_\_\_  
(PRINT)

P. O. Address \_\_\_\_\_

Signature \_\_\_\_\_

CONSERVATION COMMISSIONER

By \_\_\_\_\_

Title \_\_\_\_\_

Authorized Representative

The non-controlled or scatter-shot area appears to work very well where lands are not exposed to heavy hunting pressures such as exist close to New York City.

The first controlled public hunting area in the state was established in Putnam County in 1959 after the Board requested the Department to determine the feasibility of some kind of controlled cooperative hunting and fishing area with proximity to New York City. Conservation Aide Michael Rodak who had worked on the old landowner-sportsmen areas was given the original assignment. Through a series of contacts with landowners, he found and reported back to the Board that there was considerable sentiment in favor of an updated Cooperative Hunting Area of a least 5,000 acres in size in northeastern Putnam County. In May, the local Board recommended to the State F.W.M.A. Board that this program be initiated. In June the State Board approved, and Mr. Rodak began signing up landowners with an agreement form approved by the Department. In July mapping and posting of the area began in order to be ready for the coming hunting season. Seventy-six hundred posters of three types were erected prior to the hunting season. Type One was a Cooperative Hunting Area sign which delineates the lands open to public hunting with a permit; Type Two was a Restricted Area sign which forbids trespassing for any reason whatsoever on lands or portions of lands under lease to the state. These Restricted Areas were designated by prior agreement between the landowner and the departmental Representative. Type Number Three was a parking area sign, which indicates parking areas and gives the number of cars which can be parked in an area. Erecting of these posters was completed just prior to opening of the small game season.

The area was to be operated on a daily-permit basis, and it was next necessary to erect a semi-permanent permit issuing station where the hunters would receive and return their daily permits. This was accomplished, and the permit station also was equipped with two-way radio and a telephone. The two-way radio was destined to be the single most important factor in making the operation a success. All patrol vehicles assigned to the area also were radio-equipped to communicate with the permit station radio.

After our contact man had signed up the cooperative landowners, it was necessary to determine boundaries and the size of properties. To this end a deed search was necessary as all boundaries had to be legally posted. When this was completed, a map of the area was drafted showing boundaries, geographical features, roads, parking areas, etc. Its preparation prior to the season was essential, and it was



accomplished—thanks to the assistance of the local county sportsman representative of the Fish and Wildlife Management Board.

Regulations for daily permittees on the area also had to be drawn. Since these concerned cooperating private property owners, the Department felt it should give every consideration to their wishes (Figure 3).

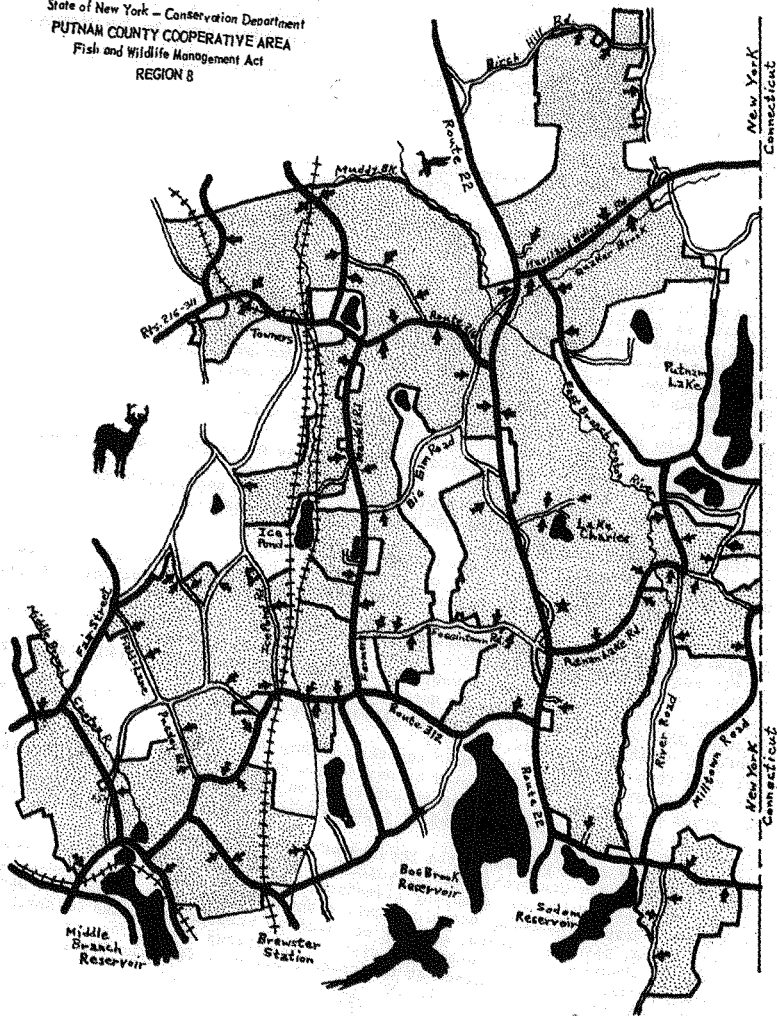
NEW YORK STATE CONSERVATION DEPARTMENT  
Division of Fish and Game

REGULATIONS FOR DAILY PERMITTEES ON THE PUTNAM COUNTY AREA


1. No hunting or trespassing allowed within areas posted as closed areas.
2. No hunting or trapping allowed on any part of the Putnam County Cooperator Area without a valid Conservation Department permit.
3. No fishing allowed during the open season for small game without a valid Conservation Department permit. During the closed season for small game, fishing is permitted subject only to obtaining the landowner's consent.
4. Daily hunting or fishing permits can be obtained only at a permit station.
5. Permit station will be open daily from one-half hour before, to one-half hour after legal hunting hours.
6. Applicants must surrender their valid hunting license or fishing license before receiving a daily permit.
7. Permits are valid only for the date of issue and they are non-transferable.
8. Armbands are a part of the permit and must be worn and visible on the left arm at all times while on the area.
9. Permit must be shown to any person requesting to see it.
10. Any person may be refused a permit or any permittee may be ejected from the area for disorderly conduct, intoxication or any other conduct which endangers the public safety.
11. Before leaving the area the permittee must surrender his permit and armband at the permit station and make a complete report of his hunting success.
12. No daily permittee shall park a vehicle in other than designated parking areas and then only if the parking quota is not filled.
13. Hunting will be allowed only on lands situated on the same side of the road on which hunter's vehicle is parked.
14. Not more than 3 hunters shall hunt together in any one party.
15. Not more than 2 dogs shall be used by any single hunter or party hunting together.
16. No target or promiscuous shooting is permitted on the area.
17. No rifles or pistols shall be used or carried afield on the area during the open season for small game.
18. All regulatory signs posted by the Department shall be obeyed.
19. The following acts are prohibited: picnicking, littering, building fires, damaging fences or molesting gates, annoying livestock, molesting equipment or other farm property, damaging standing crops or newly planted fields, taking fruit or other farm produce, picking flowers, cutting or breaking branches of trees or shrubs, hunting or shooting near or otherwise disturbing persons who may be working in the area.
20. Trapping permits may be obtained at the check station or from the District Game Manager, 105 Dutchess Turnpike, Poughkeepsie, New York.
21. Persons who desire to hunt raccoons at night must obtain written permission from the landowner prior to obtaining either a daily or seasonal Department permit. All other regulations shall be complied with.
22. After the permit station is closed and prior to the end of the small game season, seasonal permits may be obtained from the District Game Manager, Conservation Department, 105 Dutchess Turnpike, Poughkeepsie, New York.
23. After the closing of the small game season, all persons must obtain the permission of the individual landowner prior to engaging in hunting or fishing, and must have a valid New York State hunting or fishing license.
24. Permits obtained by fraud or while the hunter is suspended from using the area shall be void.
25. All other applicable provisions of the Fish and Game Law shall be in effect.

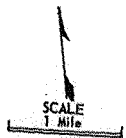
Figure 3

State of New York - Conservation Department  
 PUTNAM COUNTY COOPERATIVE AREA  
 Fish and Wildlife Management Act  
 REGION 8



LEGEND

-  Cooperative Area Boundary
-  Main Roads - Highways
-  Secondary Roads
-  Railroads
-  Rivers
-  Lakes - Ponds
-  Parking Areas
-  Permit Station



While these preparations were in process, the Regional office had to procure, train, and uniform the personnel who would operate the area. Several classes were conducted by Regional Conservation Officer George Odell and the men assigned as special game protectors were drawn from the ranks of the regular Bureaus of Game and Fish personnel attached to the regional Poughkeepsie office. It is through the cooperation, interest, and dedication of these personnel that the area is able to function effectively.

By the opening of the small game season in October 1959, the aforementioned operations had been meshed, and the area was set to operate. Some publicity had been given, and the resultant hunter pressure, while moderate at first, gradually increased.

A person coming to the area to hunt for the first time undergoes the following procedure. He is first asked to temporarily surrender his hunting license. Next he is given an armband and permit to hunt which replaces his hunting license. Then he receives a map of the area and a copy of the regulations; these regulations are explained if time permits. The map of the area indicates all lands under lease to the state and shows the marked parking areas where the hunter must park. The hunter chooses an unoccupied parking area, reads his regulations, and can then commence his hunt. Upon completing his hunt for one day, he must return to the permit station, surrender his armband and permit, and report and present his game take for the day. Then his license is returned, and he is free to leave. Landowners or their designated alternates may secure a seasonal permit entitling them to hunt on the cooperative area without checking in or out. Their reports on game taken are given to the Department at the conclusion of the season.

The area is organized through appropriate distribution of parking areas to insure hunting pressures of not more than three hunters per 100 acres. This is accomplished both by the regulations, which allow hunting only on the same side of the road as the vehicle is parked, and by strategically locating the parking areas so that one car is allowed for approximately 100 acres. Actually, records indicate that hunters average 1.8 per car, so at times the area is underutilized. Experience has demonstrated, however, that this is about the maximum pressure that landowners in this area will tolerate.

In the seven years of operation, this area has accommodated over 43,000 hunters. Hunter use of the area has averaged more than 6,000 hunter-days annually. The peak number in the first year was probably due to a special one-week post-season deer-of-either-sex hunt in Putnam County in 1959. The relatively low utilization in 1963-64

and 1964-65 was due to extended woods closure during severe droughts. (Table 1)

Each hunter spends an average of just over 4.7 hours on the area each time he goes out. Each hunter's time in and out is recorded for statistical purposes, and this figure has not varied significantly in the seven years of operation.

The popularity of this type of operation with landowners in highly urban Putnam County located about 50 miles from New York City is quite evident when we see that the number of participating landowners has risen slightly for the past seven years. The only dropouts occurred when land was sold, and usually the new owner re-negotiated a lease with the state.

The costs of operating this area have declined annually both in over-all costs and in costs per acre from a high of about \$.99 per acre to \$.65 per acre in 1964-65. This was probably the result of increased experience in the efficient use of our manpower and is about as low as we can expect to see it due to consistently rising labor costs and costs of material. This increase in the costs of labor and material finally caught up with the program in 1965-66 as is seen by the slight increase in cost per acre to about \$.80 per acre. Replacement of back-boards and signs contributed mostly to this increase. This area has been increased in size by more than 2300 acres without a commensurate increased cost for patrol and maintenance.

The use of dogs to harvest game on the area has remained at an almost constant level since its inauguration; however, during the 1965-66 season a significant increase in the use of dogs occurred. Landowners, who had been contacted expressed adverse feeling against the use of more than two dogs to a party. This was incorporated in the regulations and has been readily accepted by the hunters. Although we have no concrete evidence to support it, we feel that the use of dogs has cut crippling losses in birds by a significant margin. Further, the success ratio between hunters using dogs and those who do not is quite significant as indicated by hunter reports at the permit station.

It should be noted here that Division of Fish and Game in Region 8 does not engage in additional stocking to ensure hunter success, but stocking of pheasants and quail is continued at the rate established before the area became a Fish and Wildlife Management Act controlled hunting area. The hunter is provided with an opportunity to hunt. No fees of any kind are charged, and the landowner receives no monetary compensation other than service. The Region does apply wildlife habitat improvement programs which are carried out on the area. Some examples of these programs are border and hedgerow

TABLE 1. ACTIVITY SUMMARY PUTNAM COUNTY COOPERATIVE AREA

Year	Total Acreage	Hunter Days	Hunting Hours	Dogs Used	Game Harvest	Court Action No. Cases	Violations	Restriction from Area No. Cases	Costs	
							Fines Collected		Total	Per Acre
1959-60	9,570	7,426	31,250		1,928'	38	\$762.50	95	\$9,483	\$.99
1960-61	10,528	6,249	31,784	755	2,239''	47	\$622.50	85	\$9,284	\$.88
1961-62	10,935	6,537	31,947	527	1,741'''	17	\$375.00	68	\$9,399	\$.76
1962-63	10,935	6,478	29,209	673	1,882''''	30	\$855.00	64	\$7,619	\$.69
*1963-64	10,935	5,148	24,224	618	1,698'''''	18	\$450.00	44	\$7,460	\$.68
**1964-65	11,740	4,506	21,162	560	1,404''''''	11	\$162.50	34	\$7,590	\$.65
***1965-66	11,925	6,916	36,192	1,028	1,553	24	\$514.00	122	\$9,550	\$.80
		43,260	205,768	4,161	12,145	185	/,741.50	512	\$59,385	

\* Woods Closed 19 days—Drought.

\*\* Woods Closed 34 days—Drought.

\*\*\* Data does not include Seasonal—Landowner or Trapping Take.

' Includes 256 Trapped Animals

'' " 527 " "

''' " 220 " "

'''' " 304 " "

''''' " 396 " "

'''''' " 312 " "

plantings, small conifer plantations, wildlife marshes, herbaceous seedings, thinning and clearing, pruning, and creating hunter-use facilities, such as stiles and construction of parking areas.

Law enforcement on the area is carried out by a uniformed force of special game protectors under the supervision of Conservation Officer William Bubenicek, who has the general responsibility for the eastern half of Putnam County. These Special Game Protectors undergo training prior to each hunting season, and they are periodically tested to determine their fitness and knowledge. To date an outstanding job of law enforcement has been done by all concerned. A major share of the effectiveness of the program can be traced directly to the use of radios. The permit station has positive control of the patrolmen on the area at all times and can dispatch a unit to service any complaint on the area within 10 minutes. We have records of complaints that were answered 30 seconds after being called in. Quick response has been a very important factor in keeping the landowners satisfied with the program.

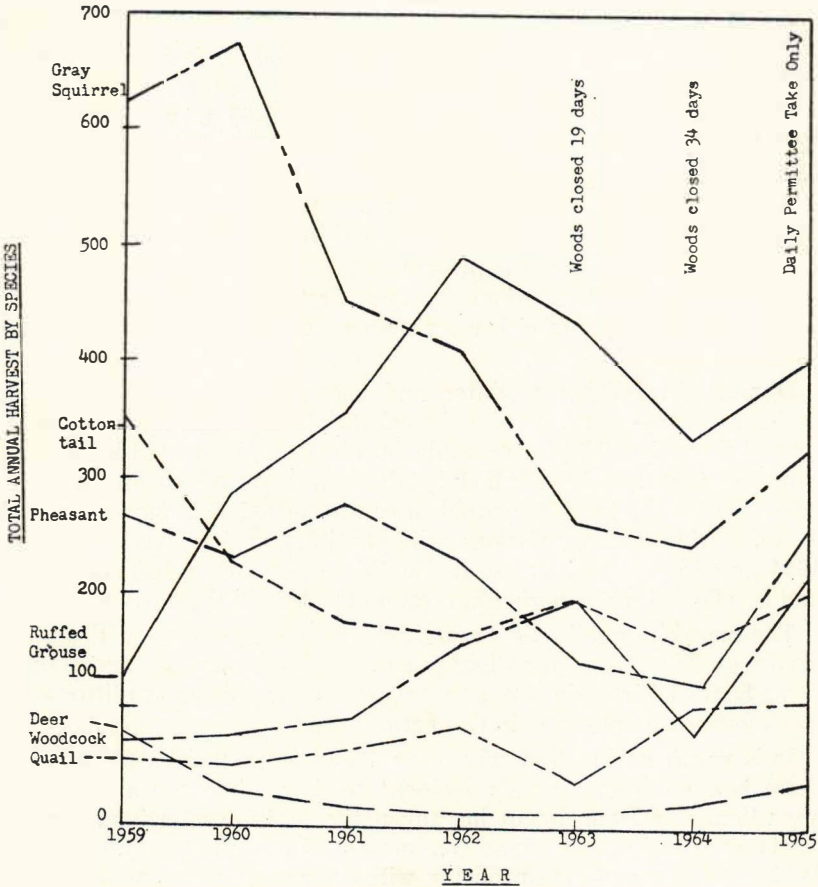
A large proportion of violations resulting in court action were for taking protected species, or taking game in closed season. Close behind this were violations of departmental special regulations. Between one and one-half and two percent of the people using the area were apprehended for intentional or unintentional violations on the area. The number who were restricted from the area for minor violations during the period of this study was in the range of one percent. Restrictions ranged in length from a period of 10 days to the entire season, depending on the seriousness of the violation and the attitude of the violator. In most cases this appeared to be a better tool than fines to ensure compliance with regulations.

The abundance or scarcity of the different game species varied widely over the seven-year period. All species were sexed and aged when techniques for doing so existed. The hunter-take figures given in Table 1 appear to be valid indices for population levels in this portion of the state since the sample is nearly 100 percent. (Figure 4)

The spectacular rise in the grouse take from 123 in 1959 to 493 in 1962 represents a trend generally found throughout the entire region. Apparently, this increase represents favorable nesting and breeding seasons such as we have had the last several years. The 1963 and 1964 seasons, unfortunately do not present an entirely accurate picture of relative abundance or scarcity of game populations. This is due to a 19-day woods closure in 1963 and a 34-day woods closure in 1964 due to drought conditions in the Northeast.

Squirrel populations were at a peak in the second year of operation and have declined in successive years through 1964; however, 1965

FIGURE 4  
ANNUAL GAME HARVEST  
PUTNAM COUNTY COOPERATIVE AREA



records indicate an upswing. It was during this peak period that the regional office received numbers of reports from the field of immigatory squirrels. The declining levels in the following four years would appear to corroborate these reports.

Pheasant populations remain at a fairly static level with a large percentage of birds taken being stocked birds. However, percentagewise the number taken is small compared with the number

stocked. This area is located in a small segment of the marginal pheasant range found in Putnam County.

Woodcock habitat is a little better than average on the area, and the increase in numbers taken is attributed to increased hunter interest plus more favorable flight conditions during the season. Woodcock harvests have increased from 72 in 1959 to a high of 216 in 1965. Lack of continuity appears only in 1964 when many migratory flights passed through during woods closure.

The cottontail decline from a high in 1959-60 to a low point in 1964-65 corroborates the records of other New York areas. This decline appears to be general throughout the Northeast. Our 1965 figures would seem to indicate that a low point in the cycle has been reached, and we can look for improvement in the next few seasons.

The white-tailed deer was present in this section of Putnam County in substantial numbers when the area first went into operation. In 1959 a one-week deer-of-either sex season was held, resulting in a high take.

During the following winter and successive ones, the feral dog problem became acute despite the efforts of Department personnel to control them. In 1960, for example, 30 deer were harvested by hunters while 38 that had been killed by dogs were recovered on the same area. Unless the feral dog problem can be solved in urban areas such as this, whitetail populations will continue at low levels. During 1964 and 1965 some increase in local deer population has been noted and is reflected in the higher harvest on the area in these two years.

The bobwhite quail exists marginally in the area even with sizable stockings. There is a very slight amount of overwintering, and returns from banded birds do not appear to warrant the expenditures for propagating and stocking in this area.

It is worth noting that with over 43,000 hunter-visits to the area, there has not been a single accident to date while the area was in operation. The Department has taken the position of refusing access to the area to hunters whose conduct endangers the safety of others. While this accident rate probably will not remain at its present level, it does indicate that when some controls on hunter behavior are exerted, the accident rate tends to be low.

The question has often been asked: where do controlled area hunters originate? This information was readily available from each hunter as he checked in. This data has been charted and appears in Table 2. Westchester County was, and remains, the highest utilizer of the Putnam County Area. The various New York City counties show very high utilization as well as Putnam County, which over the seven years



ranks third. Annual records indicate a greater local utilization which tends to show more acceptance by local sportsmen.

#### CONCLUSION

The Putnam County Cooperative Area has been a guinea pig area for public hunting in an area of high hunting pressure and high land values. The cost of operations has declined annually. The high continuing records of game populations, hunter success and hunter information are the most reliable in the New York Area. As a tool of game and hunter management, it appears to be very well suited to the urban environment in which it is located. Its value in hunter education would appear to be very high as reflected by the low accident rate.

The basic philosophy behind the operation of this area is one of giving the sportsman a place to hunt without obligation other than law-abiding and courteous behavior. In carrying out this philosophy, we relegate game take per hunter to second place behind the opportunity to hunt and get in the field. Hunting opportunity is not too common, without trespassing, in the New York Metropolitan region, and the Fish and Wildlife Management Act Cooperative Areas provide this opportunity.

Game take per hunter on a seasonal basis is one piece of game per 4.3 hunters. This has varied somewhat from year to year without any noticeable dissatisfaction on the part of the sportsmen. Therefore, a full game bag may not be as important as the recreational value derived from a day afield.

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#### DISCUSSION

**DISCUSSION LEADER CRAWFORD:** This is a report from a state that has embarked on a program of trying to open up private lands to public hunting. I would be remiss if I did not point out that it is not just the northeastern United States that has a problem of hunter access. I think this is probably a national problem.

Of course, we in Missouri are faced with it every day. So much of our game is grown on private land. I think the national average would be 80 to 90 percent of the small game in the United States on lands with private ownership, so any key and any guideline to opening these lands on an equitable basis for both the landowner and the hunter is always a highly sought technique.

I would open the floor for discussion at this point. There surely must be comments on the success of this.

MR. LARRY R. GALE (Missouri): I think you touched on this to some extent, but I wondered if you could tell us just what are the advantages to the landowner in this program.

MR. MCKEON: Well, the main advantages to the landowner, of course, are the protection aspects of controlled public hunting. The landowner doesn't have to carry out any of these operations himself, and generally these are landowners that have small holdings in the country. In Putnam County they were not generally operating farmers. There were some. Probably a third were operating farmers, but in general they didn't want the problem of having to post, apprehend and prosecute people who were coming on their property.

We have a tremendous problem with people from New York City and other areas of the state who do not have an area to hunt, and this provides them with a place to hunt and keeps the problem to the landowner at a minimum.

In addition, the landowner is given any kind of technical advice on wildlife problems. He is given a free subscription to our Conservationist magazine, and he is provided with any information that he needs to carry out his own management programs, such as building wildlife marshes, wildlife ponds, or construction work and sometimes stream improvement work.

MR. ERNEST PAYNTER (Saskatchewan, Canada): Do you make a charge for the permits?

MR. MCKEON: The only charge that is made is that the hunter must have a valid small or big game hunting license, depending on what he wants to hunt.

MR. PAYNTER: Do you know the number that enter each day?

MR. MCKEON: Yes Sir, I think in this area the quota is 330 or 340 at the present time.

MR. PAYNTER: First-come, first-serve?

MR. MCKEON: First-come, first-serve, and they average about four and a half hours of hunting during the day. When they leave the area that they are using can be turned over to another party.

MR. PAYNTER: One more thing. You referred to 90 cents for something, but you didn't say what it was for.

MR. MCKEON: For cost of operation and maintenance of the area. Eighty cents per acre.

MR. JAMES JACK (Minnesota): Are these people cooperating primarily hobby farmers? And also are there a number of them that are absentee owners?

MR. MCKEON: We have a number of landowners who are actual dirt farmers, but the majority of them are people who work in New York City or some suburban area and come there for their rest and relaxation. In fact, this is probably one of the incentives to sign up for some of the people because they aren't there to protect their property. We are there, and we try to give them a partial protection.

DISCUSSION LEADER CRAWFORD: I detect a significant difference here in the minds of some people between true farmland country and this partial residential type of farmland.

I couldn't help but do some division up there. It looked to me like 80 cents an acre, but it is about a dollar and a half per hunter. If I did some other dividing, it showed that there was about one head of game for about 10 acres, so this is a real nice rackup, a good progress report on an interesting program for New York City. I think we should keep our eyes on this.

MR. DONALD W. THOMPSON (Ohio Division of Wildlife): In Ohio we have approximately 300,000 acres now in the cooperative range. This is on an individual landowner initiative basis. In other words a contract basis.

We are wondering if you in New York are considering such a program, and if you are, if you intend to approach it on the basis of checking station, active control, and that sort of thing.

Our present price for the program which we are embarked upon in Ohio is approximately  $3\frac{1}{2}$  to 4 cents an acre, and it might be worthwhile thinking about something additional here.

I notice there is quite a disparity between cost per acre on your controlled area as opposed to the one we have in the State of Ohio.

MR. MCKEON: I don't think we will ever reach a low figure of 31½ cents an acre, but we do have another scattershot program which is similar in nature and set up under the same general Fish and Wildlife Management Act. The scattershot program involves individual landowners whose holdings may be in a random pattern so that it is not possible to concentrate patrol. However, patrol is provided during the open season, and the regular conservation officer, in general, handles this with one or two special conservation officers who may be assigned.

We don't hope to get down to 3½ cents an acre, though.

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## OPPORTUNITIES UNDER THE CROPLAND ADJUSTMENT PROGRAM

E. A. JAENKE

*Associate Administrator, Agricultural Stabilization and Conservation Service, U.S. Department of Agriculture, Washington, D.C.*

We have the opportunity—over the next four years—to put into long-range conserving uses an area of cropland equivalent to all of Ohio and half of Pennsylvania. The chance to make major changes on such a large acreage in such a short space of time isn't given to every generation of conservationists—and may not be again.

It is for that reason that I am pleased to talk with you, my fellow conservationists, about the wildlife opportunities in the Cropland Adjustment Program. The realization of these benefits will depend upon a great deal of work and cooperation among wildlife conservationists, farmers, and the Department of Agriculture. The chances for more and better wildlife are built into the CAP—but if farmers don't take advantage of the opportunities, this potential can easily be lost.

Let me describe CAP briefly, and tell you what we in the Department of Agriculture expect from it.

The Cropland Adjustment Program, which was authorized in the Food and Agriculture Act of 1965, calls for shifting up to 40 million acres from producing surplus crops into conserving uses under agreements ranging from five to ten years. Most of those acres are now being diverted on a year-to-year basis under the annual commodity programs. CAP is designed to supplement the annual programs, to take some of the pressure off them. Farmers can divert on a long-term basis for less money than they would need under an annual program.

Farmers who sign CAP agreements will receive adjustment payments to compensate them for part of their loss of crop income. Federal cost-sharing will be available to help them install conservation practices where needed. Additional incentive payments are authorized to increase public access on land diverted under the program.

One special provision of CAP has been given the designation "Greenspan." Under it, the Secretary of Agriculture is authorized to transfer funds to state and local governments to help them purchase land that has been producing surplus crops, so it can be switched permanently to green spaces—parks, recreation areas, air and water pollution control.

Just as on the farm side of CAP, the Secretary is authorized to share with the state and local governments the cost of establishing conservation measures which will protect the land in its new use.

Bear in mind that the primary objective of CAP is to avoid surplus production by a means less expensive than the annual commodity programs.

We expect that CAP will have a special appeal to older farmers who wish to retire—farmers who want to live out their lives on the home place but don't feel up to the physical activity that full-time farming requires.

We expect that CAP will appeal to part-time farmers, people who live in the country, farm on the weekends and at night, but go to work in the city every day to make a living.

We do not expect that CAP will have its primary appeal to the great mass of American farmers—those who live on adequate, commercial family farms and who make their livings at producing this nation's abundance of food and fiber. But even some of these will wish to discontinue under CAP the production of one or more crops in surplus.

We expect CAP will divert about 7 million acres this year, perhaps an acreage of 7 or 8 million more each of the next four years until we have approximately 40 million acres in the program.

We expect that these acres devoted to conservation uses will be located throughout the entire nation, in practically every county. Some of the land will be close to cities; some will be far away from population centers. All of it will be devoted to grass, trees, shrubs or other conserving uses instead of surplus crops.

This is where we find the opportunity for wildlife benefits.

Secretary Freeman has appointed a Wildlife Advisory Board to help formulate the wildlife features of CAP. Among others, C. R. (Pink) Gutermuth and Tom Kimball are members of that board.

At our first meeting a few weeks ago, the Board recognized the opportunity for increasing wildlife habitat and recreational possibilities in the program. The members recognized that farmers must participate in the program if they are to take advantage of the wildlife opportunities, so they urged farmers to make full use of the program.

Members of the Wildlife Board recognized that individual farmers may not realize the real and pressing need for more and better wildlife resource conservation, so they urged the Secretary to make the incentives for wildlife practices as attractive as possible.

Acting on a suggestion of the Board, the administrator of the ASCS—Horace Godfrey—immediately wrote to the state ASC committees urging them to take another look at the wildlife features of both CAP and the Agriculture Conservation Program which for 30 years has shared with farmers the costs of carrying out conservation measures.

He asked the state committees to review their decisions on wildlife practices and cost-share rates with state game and fish commissions to discover if these practices need to be adjusted. And he asked for a vigorous joint effort to be sure that farmers fully understand the desirability of improving our wildlife resources.

The wildlife conservation practices—habitat plantings, food plots, development of ponds and shallow water areas and the like—are available to all farmers who enter the program. They can choose those practices or any of the other conservation measures that will shift their land out of crop production.

Those who ask for an additional incentive payment to permit public access will be urged strongly to use wildlife practice cost-sharing to improve the wildlife resource of their lands.

The rates will be set up to offer a reasonable inducement to the farmer to open his CAP land to public use for the authorized purpose. We hope they also will reflect the extent to which these lands are *desirable* to recreation seekers.

This might mean the establishment of different payment rates according to the quality of the hunting and fishing that can be provided. The highest rate would then be offered for land which has the resources to provide *excellent* hunting or fishing—or land which could do so with the help of an approved wildlife plan. A lower rate might go for land which will provide *above average* hunting or fishing. And a third and still lower rate could be determined for land which would provide only *good* hunting or fishing.

Generally, on those lands no additional rates will be provided for hiking or trapping—these uses to be included where appropriate in agreements to permit hunting or fishing. In some cases, however, a rate might be established for hiking or trapping, where there is a particular need for these uses. In other cases, and over-all payment for fishing access might be established instead of a per-acre rate, but again it must be related to the acreage designated under the CAP.

A key figure in all of these determinations will be the local

representative of the State Game and Fish Department. We expect that each farmer requesting the incentive payment will be asked to get in touch with this "wildlife representative." We will look to him to help rate the desirability of a given area for the four public access uses specified in the law—and to suggest and additional conservation measures needed to improve the wildlife resource.

The producer who signs such an agreement will be obligated to carry out the wildlife practices and management measures, to permit public access without restriction other than that specified in his agreement. Steps should also be taken to let the public know that the land is under a CAP public access agreement.

As you can see from these plans, we expect to work closely with the people who know best the wildlife needs in the states and counties. We solicit their suggestions, and we expect to work closely with them to make the best use of wildlife resources.

Wildlife organizations, both locally and nationally, can do much to help make the CAP serve as an important tool for wildlife resource improvement. But we are not, and will not, and cannot be in the position of attempting to force the farmers of the nation to decide in favor of wildlife. We will do what we can to show them the desirability of wildlife conservation. We are doing this now in the Agricultural Conservation Program and expect to do it in the Cropland Adjustment Program.

But we have found that the best use of wildlife conservation practices in the Agricultural Conservation Program comes in those areas where wildlife conservationists and sportsmen's groups work directly with farmers. There have been many examples proving that local cooperation pays off for wildlife. And you are the people who can help most.

I know that the people in this room come from many different kinds of jobs and responsibilities—joined together here by the strength of your interest in wildlife and the strength of your efforts to save our fish, birds and wild animals and to increase their production. I want to make certain suggestions, however, which I think almost everyone of you can do when you return home—to advance the wildlife

#### OBJECTIVES OF THE CROPLAND ADJUSTMENT PROGRAM

(1) Talk to your friends in the game and fish commission or department of your state. I recognize that many of you represent that department—and in any case you are well acquainted with the people there. Emphasize to them that the Department of Agriculture is looking to them to provide not only professional advice but also state

and local motivation for progress under the wildlife provisions of CAP.

(2) Get in touch with the sportsmen's clubs that are prominent and active in your community. Acquaint them with the wildlife provisions of the Cropland Adjustment Program and enlist their interest in talking with farmers and farmer groups about the mutual advantages of expanding the wildlife potential of your community.

(3) Talk with farmers yourself. Visit your local Grange, the Farm Bureau, the Farmers Union. Talk with their members about the advantages of the wildlife assistance offered not only under the CAP but also under other state and federal programs—the Agricultural Conservation Program and the Soil Conservation Service, for example. After all, 80 percent of the wildlife available for hunting is on private lands, and we will have to turn increasingly to private land to meet our growing recreation needs.

(4) Talk to your state and county ASC committeemen. Here again, you will be talking with farmers—state and local farm leaders who have the responsibility for administering the wildlife provisions of the Cropland Adjustment Program as well as many other programs. Let these men know that you are interested in making CAP work as a builder of the wildlife resources of your area. These men are like all of us. They have a great deal of work to do. They have many things on their minds. And they are more likely to give increased attention to a specific program if they know that their community is interested in it.

It is you who can best show the individual farmer his advantage in conserving wildlife, providing habitat and food plots.

It is you who can show the farmer the personal satisfaction that comes from knowing he has had a hand in providing a place for birds and small game.

In some cases, local groups do a great deal to help farmers make this switch from crop production to wildlife production.

It is you who can help bring about needed adjustments in laws to protect from undue liability farmers who permit use of their lands for recreation—who can help create an atmosphere of responsibility by sportsmen which gives farmers assurance that they will not suffer damage, annoyance and inconvenience from opening their lands to the public for hunting and other desirable outdoor recreation activities.

Together, we can give wildlife conservation a real boost—we through the Cropland Adjustment Program and cost-sharing for wildlife practices—you by showing the farmer and the sportsman that both have a stake and an opportunity for public service in the improvement of wildlife resources on agricultural lands.

## DISCUSSION

DISCUSSION LEADER CRAWFORD: Thank you, Mr. Jaenke. This is a real opportunity for the members of this conference to communicate directly with the Washington level in this very important area of wildlife work. We have been waiting for some time to see this CAP work finalized.

MR. BOB CURTIS: I would like to ask one question. I am not quite sure whether or not the payment to the farmer is in one lump sum, or is it in various stages or progressions? Whether to enter into the program would be number one. To carry out wildlife practices would be number two. Number three would be to permit public access.

Is there a different rate of payment to farmers?

MR. JAENKE: That is a real good question. Here again, and in many other questions similar to this, we hope to have some information, not real technical information, but the answers to specific points like that raised here, available in county offices and through other means very shortly.

Let me answer now your specific questions. Number one, the farmer has a choice of a lump sum or annual payments. If it is a lump sum, it is reduced by the rate of interest that he would normally earn on this money. Number two, he first signs into the program, and then we put in effect an amendment to his contract to cover the wildlife and public access opportunities. In that case, assuming this was available, we plan to let the state game and fish departments and commissioners together with SCS, and other conservation groups in the state decide the applicability of this by areas, by individual counties, and so forth.

Then, if it is available in the particular area, he would be eligible for some very small inducement or incentive payment for permitting public access.

Before he would get this, however, he would have to meet certain minimum criteria from the standpoint of the wildlife conservation and development. He couldn't just open his lands up and get this. He would have to make them worthwhile for hunting, fishing, or recreation.

MR. CURTIS: One more question. Can the states expect an interpretation of the law to follow in the near future?

MR. JAENKE: Very, very soon. The plans are right now in the lawyers' office getting cleared, and it should be just a matter of days.

MR. CURTIS: Arizona is very enthusiastic about this program, and we hope to see something very quickly. Thank you very much.

MR. THOMAS EVANS (Illinois): My question is along the same general line, though more specific, and that was as to when we might get some word on the rate of payment for permitting public hunting.

The program appears to have considerable interest in Illinois, more so than we had hoped for, particularly in our corn and soybean area. As of February 26th, we were given a tabulation of 442 requests or inquiries about the program. This does not mean, of course, there will be that many contracts, but there is this high expression of interest.

At the moment we do have a request from an owner of something over 1100 acres who is specifically interested in the wildlife phases, and wants to open it to public hunting. The ASC people have referred him to us, and he has asked us what are we going to get, and we don't know. We would like to know when we can be given this answer.

MR. JAENKE: Real good. I am very interested to hear the interest in Illinois. We too have found in certain areas and particularly in certain states a great deal of interest. Then this sort of psychosis, I guess you might call it, about the idea that we are going to need to and take every acre and put it back into production seemed to take over, and quite frankly, the interest and the final signing up of contract by producers had, from most reports, dropped far behind early anticipation.

I think this is being overcome by some very responsible statements on the part of farm leaders throughout the country telling farmers that this is not the case,



and we still have this capacity to overproduce by 10 to 15 percent, even above our needs as we foresee them.

We are very much concerned about the timing of getting it out, and the delay. The Wildlife Board when they were in two or three weeks ago expressed some of the same concern.

Only in the way, I guess, of an excuse, this is a new program, and it is completely different from any that most of us have been acquainted with and working with in the past. Hence, it is taking a little longer, but as I indicated, the last step has now been reached. The plans are in the legal offices in the Department, and as soon as we can break them loose there, it shouldn't be very long before they will be out and in the field.

This will include specific instructions to state committees which will be in touch with you and with your counterparts to work out some of the specifics.

I might advise you of one point. We do not intend to prescribe a specific rate for every state or every county but ranges. Then the state game and fish commission and our ASCS people and others in agricultural and conservation communities will develop the specific amounts within these ranges and make basic decisions as to the value of an individual area of 1100 acres vis-a-vis a 200-acre spot over on the other side.

MR. JACK BARTLETT (Ohio): Sir, you indicated that this program is designed to help the small farmer and also the elderly farmer who may want to cut down on production.

I would be interested to know whether you feel this will really be a significant contribution to these people and help keep them on the farms, and if so, whether you feel that they are really going to be willing to grant permission across the board to hunters for five to ten years.

MR. JAENKE: Number one, I think a lot depends on the type of effort and the success of that effort that our own people and the sportsman's groups and fish and game commissions do in terms of educating and informing these people. We do not anticipate this would be required on a ten-year basis, I might say, as an afterthought here.

Secondly, as to what this means in terms of both the production and balancing aspects, as well as the hunting and fishing, each bushel of corn produced, whether it is on the most efficient, finest farm in Champaign County, Illinois, on an Ozark farm in my own state of Missouri, that bushel of corn adds to the markets. If you are at the point where you have more than you can use effectively and properly, both domestically and for dollar exports as well as for foreign aid food commitments, that bushel of corn is just as costly to you and me and the taxpayers and just as hurtful to farmers from the standpoint of its price-depressing effect. I didn't mean to imply that this program was limited to elderly or part-time farmers, but I think by its very nature, a fellow 35 or 38 years old, with three kids growing up, isn't likely to want to take his land out of production for a ten-year period. We would expect that he would rely more on the annual programs, and in this way carry out some benefits, but it would not be limited.

However, our estimates and studies, and we have about three years' worth of checking individual cases as well as some broad studies conducted in cooperation with some of the land grant colleges, would show that the greatest interest is by two general groups. First is the part-time farmer who is working in a job in town but wants to raise his kids a little better than on the streets of the town, city, or suburb, and therefore is living on 40 or 80 acres. The other one, is the farmer who is approaching that age where for health and other reasons would just as soon not farm as extensively. It would be available, of course, to all.

As to whether or not they are going to participate in the program, again this depends on the effort we do in educating, informing them, and stimulating them, if I might use that word.

When you see the example that the gentleman who preceded me showed in New York and their degree of cooperation there, I think you can see some real opportunities. This doesn't mean that this program is going to be patterned

exactly after that or anything else, but I think it deals with the same over-all problem.

There are going to be problems, which we recognize, but we are very enthusiastic and very hopeful.

This is one of the great needs in this country, and if we can accomplish two goals, that of balancing our agricultural plant and at the same time provide greater recreational and hunting and fishing benefits, we have accomplished a ten score.

MR. ROBERT D. PARLAMAN (Pennsylvania Game Commission): You mentioned the word "communication." We in Pennsylvania have numerous programs set up, and I just wonder how this is going to apply. Let us say where a landowner is not associated or affiliated with ASC or the SCS Program and his neighbor is. You pay one and not the other. We have as high as 5000 landowners cooperating in an open hunting access program free, although we do give services. We have a whole county that has no ASC, and still, unfortunately, I would say this is not affiliated with the Soil Conservation Service. It is one of the thinly populated areas of the eastern United States. These are some of the things that I hope we communicate with before we apply this sort of thing. We have actually gone out in an all-out effort to avoid cash payments.

MR. JAENKE: Number one, I would say Amen to your statement about the need for close liaison and communication. This is one of the reasons why the Wildlife Advisory Board recommended that the discretion be left in the hands of the state people to decide the areas or the applicability of the public access feature within their states, and I think there is going to be a variation in the need for it and the desirability.

One of the members of the Board came from a state where they have worked out a program along this line. I forget the specific rate, that is made available to farmers. Twenty-five cents an acre maybe it was. He indicated, in this particular case, that they have had a problem of making sure that the entire block of land goes into the program, and I think this is the one you were referring to. Certainly there is going to be a big difference between a state like Colorado, particularly in some of its less inhabited areas far away from the people, and another, let's say, like Virginia, where there is a great deal of need for it.

I think a lot depends on the degree of effort a state has made in preventing the posting of land and taking other steps to alleviate this problem.

Certainly we recognize, and we hope you do, too, that this is a new and from the standpoint of the Federal Government, somewhat of a pilot effort in this area, and we are hoping to keep the maximum degree of flexibility and the maximum degree of discretion and decision-making in the hands of those on the ground floor who know the situation, and this does very definitely call for close liaison and communication.

MR. THOMAS EVANS: Just to follow up on the comment in reply to my previous question. As I interpret this, the state game and fish people will be relied upon to aid in determining the payment that might be made within this range which will probably be applicable to counties or perhaps geographical regions of the state.

If this were the case, then I would think that we might well go home from here and start working on this right now if this is going to be a problem. It is something that most of us had hoped that we might avoid, having to get into differential rates between farms even within geographic ranges, to say nothing about getting down to counties, but if this is the way it is, this is something we are going to have to tackle.

I have one other question which has been asked of us. Is it possible under this program for a state, for example, to make a similar payment to a landowner for those acres of his farm which are not included in the CAP Program, which are not eligible acres, and thereby get this entire farm open? Might he also charge a hunter for hunting on the other acres that he can't charge for as CAP acres for which he is getting a payment under the program?

MR. JAENKE: Nothing that we have in mind would prevent a program such as

you indicated in which the state would be involved in one area and the Federal Government in the other area. Our requirement by the law would be, of course, as you indicated in which the state would be involved in one area, but there could be no fees charged then for the Federal access. This is public access in the true sense of the word, but I sure don't see how there would be any complications with the other one you mentioned. I would like to think about it a little more, but I can't see any right off hand.

MR. A. HEATON UNDERHILL (Bureau of Outdoor Recreation): I would like to ask two questions that I think would be of more or less interest to the group. One, do you anticipate a different payment for public access for let's say, less irritating uses, such as hiking, picnicking and so on than would be paid for public access for hunting, which is something that a man usually is posted against; and two, while I realize you haven't set the rates, I don't think the group here has any idea at the moment whether you are thinking of incentive payment for public access in terms of 10 cents an acre or in terms of 5 dollars an acre.

Now could you give some indication of the general area that you are thinking of in this respect?

MR. JAENKE: You are way too high on the 5 dollars an acre. Some of the advice which we have been given would indicate that something in the range of from 25 cents to perhaps one dollar an acre is in the range we are thinking about.

The last question you asked referred to different rates for different recreation use in its broadest context.

We had envisioned that to meet these requirements there would probably have to be one individual rate which would probably be based on hunting or fishing access. Maybe you might have two of these, and again we are not going to spell this out from Washington in great detail, but permit the states and the counties to decide on this within ranges. But we had anticipated that there would probably be one or, at most, two rates, and that the camping or the hunting aspects would probably be quite limited and could probably be dealt with under this aspect of the program rather than the other.

DISCUSSION LEADER CRAWFORD: I think we will close this program. I think a comment of interest here would be that a group of Boy Scouts on a hike aren't any worse than a hunter or vice versa.

We thank the panelists and the participants for a very excellent presentation, and I appreciate the audience response to the discussion. I will turn it back to Fred Stanberry. Thank you.

CHAIRMAN STANBERRY: Thank you, Bill, and I would like again to thank Pink Gutermuth and Robert Smith for the fine program.

I, too, would like to thank you for your attention and your discussion and questions.

# TECHNICAL SESSION

Wednesday Morning—March 16

*Chairman:* FRED E. MORR

Director, Ohio Department of Natural Resources, Columbus

*Discussion Leader:* FRED L. JONES

Director, California Department of Parks and Recreation,  
Sacramento

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## WHAT'S AHEAD FOR OUTDOOR RECREATION PROGRAMS?

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### REMARKS OF THE CHAIRMAN

FRED E. MORR

I would first like to say that we are disappointed to have been advised that our scheduled discussion leader, Fred Jones, of California, will be unable to be with us due to a legislative budget hearing. If there is no objection, the Chair will function as discussion leader also this morning.

To me it is significant to note that, at this Conference, we are talking about outdoor recreation or, to word it a little differently, multiple use.

In Ohio, where nearly 11 million inhabitants seek the varied pleasures and pursuits offered by nature's bounty, we are particularly aware of the need for compatibility of resources, wildlife, and recreational interests. We in the conservation field, be it wildlife, forestry, or parks, are in the business of recreation and, quite frankly, we have been for some time. As a result, single-purpose management philosophy is a singular and thus limited funding. On the other hand, the multiple-use philosophy implies that the financial burden be shared by all recreational interests and equitably distributed among all recreation sections.

The foundation upon which we center our interest this morning is

the Land and Water Conservation Fund Act. We are to have a close look at the potential effect of the funds provided under this Act, the effect they will have on outdoor recreation programs of state, county, and municipal organizations. We are going to examine the possible effects of this upon our wildlife resources. We are going to bring out the problems of administration and implementation, and we shall hear of elements comprising a successful state plan under this Act.

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## FINANCING MATCHING FUNDS

L. P. VOIGT

*Wisconsin Conservation Department, Madison*

This panel assignment, "Financing Matching Funds," has a certain unique nightmarish quality about it. This is not a subjective judgment of mine alone. Psychoanalyze any state conservation agency administrator these days and I'm sure you'll find he enjoys at least one recurring nightmare on a regular fiscal basis. It's that he'll wake up some morning and find his budget bereft of matching money for federal aid and his agency abandoned and without a program like poor motherless Eve when she succumbed to the temptation of the apple.

The aids programs are vast and their benefits indisputable. However, they have an appetite for matching money which threatens eventually to put the kibosh on common state-federal goals.

There is no denying the primacy of the goals, but as a state agency administrator, I feel that achieving them requires emphasis on "give" at both levels, with states not only accommodating to federal necessity, but vice versa as well.

The trend toward bigness has taken effective taxing authority with it to Washington, and financing resource management programs in state government is really pretty much a catch-as-catch-can proposition. In Wisconsin, thanks to the leadership of Senator Gaylord Nelson when he was governor, we have ORAP, the Outdoor Recreation Act Program. This is financed by a one cent per pack tax on cigarettes. It has added \$14.7-million to conservation coffers in the past five years. I recommend a similar program to anyone who can get it. It's given us matching money when many another state has had to scratch.

But over in my comptroller's office, the budget boys are telling me that things aren't all coming up roses. The next biennium will find Wisconsin scratching along with everyone else, and the "pickin's" are slim.

We've thought of all the standard solutions—another penny on cigarettes—bonding—general fund appropriations—a use tax—higher license fees—stamp plans, parks stickers, and rebates for motorboat gasoline. In Wisconsin we've even looked longingly at beer and cheese—which shows how desperate things can get. As a matter of practical politics, nearly anything that soaks a voter is a delicate matter—beer and cheese being more delicate in Wisconsin than say oleo.

The point is that while today there is serious drought, tomorrow sources of state matching money may just dry up.

I've mentioned one reason for this—Washington has preempted our taxing authority, leaving us only property and sales taxes—poor candidates for new burdens.

Another reason involves diminishing returns. Federal aids have enabled the states to invest in recreational capital. But as the plant grows, operational costs grow too, and more money must be diverted to keep steam in the boiler. When the big push stimulated by the Federal Land and Water Conservation Fund reaches a climax (we call this program LAWCON in Wisconsin and we're mighty happy to have it too) but when it reaches a climax—to coin a phrase—none of us may have a stick left to match.

A part of my thesis then, is that state matching money is in short supply, and grass roots money even shorter. As I see it, our responsibility is to do something that will keep the cooperative job from bogging down when the shoe begins to pinch a year or two from now.

First, I propose for consideration that matching requirements be eliminated altogether on many programs.

If this is too liberal and too soon, I suggest drastic reductions in matching percentages—or a gradual annual decrease in cost share requirements as matching cash grows scarcer.

Possible under LAWCON, without further ado, is revision that would permit operational expenditures to qualify as a matching contribution.

And finally, I submit this idea to federal administrators:

Why not an installment-plan pay system for the state's share of matching funds—especially for big programs like LAWCON? This could reduce the annual cash outlay to a fraction of what might otherwise be required. In effect, it would amortize the program and probably assure universal continuing participation.

I hope you do not believe these ideas play fast and loose with Big Brother's bank book. Federal money, you know, really belongs to us home folks.

National agency people here are all aware of the criticism their cost share programs elicit as they grow in size. It's no secret that many states view some of these aids as pocketbook arm-twisting. On the other hand, because federal agencies have a pretty well-defined job to do, they may consider this attitude to be mere petulance.

And the state may consider the federal attitude to be one of arrogance. Neither, of course, is true.

A state administrator like myself might hate himself forever if he looked a pile of available resource conservation money in the eye and failed to figure a way to get hold of it. On the other hand, he's got programs the folks back home think are important, too. Even in Wisconsin where resource management is financed on a relatively affluent basis, we're worried about the slant in program federal aid fosters and we work to guard against it. The pressure is greater on states without any money cushion. Many feel they've already sold some of their home programs down the river—and they see more in the offing!

The adjustments I suggest would allow both state and federal agencies to work with equal integrity.

To eliminate matching requirements completely is no great heresy. I cite the \$46-million per year paid to land grant colleges for agricultural research. This perennial gift has built these institutions into power centers for agriculture throughout the country. We in conservation and resource management have an even more basic claim. And we are no less responsible!

The concept you often hear in favor of the cost share idea—that if you put in your own money, you'll treat it better—is fallacious simply because, as I said before—it *is* our money. That you get more work done is relative—you get more of one thing and less of another. As for control—for every direct grant, federal qualifying criteria and subsequent inspections can steer any program down the straight and narrow.

Percentage formulas on matching costs are predicated on the amount of work they'll stimulate. Seventy-five federal and 25 state keep wheels moving in Dingell-Johnson and Pittman-Robertson—but it takes 90-10 for the Neighborhood Youth Corps. I commend P-R and D-J formulas to LAWCON authors for study and predict with confidence that large amounts of grass roots aid will go begging, along with some destined for state moneyboxes too.

Wisconsin has a few aid programs of its own, and we've found that county boards don't cause any traffic jams waving dollar bills at us under a 50-50 formula. Competition for the matching buck comes from all over the landscape, and in Wisconsin we're going to have to

make revisions in favor of the grass roots to really get these recreational developments off the ground. Right now the State of Wisconsin can qualify for aids under 25 different titles in resource management alone. I think all of these matching programs are already threatened by a buyer's market. Of course this isn't true in the rich metropolitan areas. They've got on-going programs that can qualify as matching for all the federal aid that comes their way. This is why there's need for re-thinking. Even big city people prefer the boondocks for their recreation. They don't cotton up much to the kind you can build into a 20-story building or a two-acre parking lot.

Another trouble with many of these formulas is that the wealthy state gets the cream. Even under the relatively liberal P-R and D-J formulas, Wisconsin and some other fortunate friends in past years picked up a lot of default money that deserving neighbors just couldn't afford at the time.

In our state, we'll take the Neighborhood Youth Corps at 90-10, but at a 50-50 rate contemplated for the future, we can probably get more for the dollar elsewhere.

The states realize, of course, that any formula shifts require amendment to existing law. Incidentally, they could be pretty sure of only small Congressional resistance if revisions are backed by federal administrators.

However, a change that would allow operational cost to qualify as a matching contribution under LAWCON is merely a matter of *interpretation* by the Secretary. There is plenty of precedent. Right now we're permitted to cost share research operations under P-R and D-J. Our Clarke-McNary aids help with operations in fire protection and cooperative forest management. These are all remarkably successful programs.

I'm not so visionary as to believe that these suggested changes have a chance as long as cost sharing stimulates action—nor do I necessarily think they should. However, I'm optimist enough to think they will in the future merit serious review when aid programs finally get "the slows."

And I predict that'll happen.

The idea of installment plan buying doesn't need too much elaboration. One thing I can vouch for—it works. I'm sure everyone here on a state or federal payroll has already been coerced into agreement.

Before concluding, I'd like to talk a little bit about where state and local resource managers can look for matching money. One place is right in the mirror.

Paralleling cybernetics, automation and a soft landing on the moon



is the recreation revolution. I think LAWCON touches the pulse of this change, and we have to swing with it.

A lot of old programs are geared to what people used to do. Some are discredited but carry on because of political pressure. A lot can be junked, refurbished or reorganized—at a goodly saving in cash—and the money should be spent satisfying the new and modern customer we serve.

I'm not going to embarrass anyone by reciting chapter and verse on these generalizations, but I'm sure every administrator here is on speaking terms with all the skeletons in his own particular closet.

We need to be modern and efficient, and we need to continually promote the idea of a broad-based support for resource management. There are gimmicks, like using gifts from private sources for a matching contribution or taking payment in "kind" for work done, but total tax-supported income balanced against program costs is the final limiting factor on how much federal aid we can actually match.

As an administrator prone to the aforementioned nightmares, I'm hoping that, when we peak out, we'll get some help in the form I've tried to detail. Then maybe that recurring dream will turn out to be just that, and we won't be stranded outside the Garden with poor motherless Eve after all.

#### DISCUSSION

CHAIRMAN MORR: Thank you, Mr. Voigt. Now then, do we have any discussion?

MR. JOHN V. KRUTILLA: I was interested in the comment by Mr. Voigt that we ought to consider policy with respect to having matching funds on the installment plan. I wonder if thought has been given to how effective user charges or fees might be in amortizing such installment purchases?

MR. VOIGT: As I pointed out, our experience with user fees has been through the park sticker. We have been rather disappointed, just as the Federal people were under the Land and Water Act provisions. But, on the other hand, it still is good money and goes to the park because, after all, we are talking about a bonding program. In other words, all of the hard-headed bankers in Chicago were very willing to finance a recreational program, putting up the users fee moneys as security for amortizing capital investments. On the other hand, I think the pinch is going to come in our operational funding when we get this big recreational plant. I hope, after we get some of these plants, that we can continue to operate them. To me that is the more serious problem.

CHAIRMAN MORR: I feel that the point raised by Mr. Voigt in talking about future conditions of existing programs is of great importance to us. So often we look at the past, we contemplate things in relation to the past and often harass ourselves with relation to past activities. However, we must also consider the future in relation to these problems.

## NEED FOR COUNTY PARTICIPATION

KENNETH J. SMITHEE

*National Recreation and Park Association, Washington, D. C.*

During the next thirty-four years, the population of this country is expected to increase from 194,000,000 to an estimated 350,000,000 with most of the growth occurring in the fringe areas of the metropolitan regions. Numerically speaking, another United States will be created. Paramount among the many problems which the various levels of government will be facing as a result of this rapid population increase is that of providing the public with adequate parks and recreation areas, facilities and programs. I believe, based on current trends, the primary responsibility for providing these new facilities and services will be that of county or metropolitan governments.

Most people are not cognizant of the fact that approximately two thirds of the nation's residents are located in areas under county jurisdiction. An estimated one third of the citizens reside within incorporated areas, *i.e.* cities; one third in the suburbs; and one third in rural localities. Thus the opportunity and responsibility for providing parks and recreation services falls squarely on the shoulders of county governments which have jurisdiction in the suburban and rural areas where most of the future growth will occur.

According to the ORRRC Report, the most pressing public recreation need is the provision of lands and facilities in and adjacent to metropolitan areas.

"The first task is to provide recreation for the metropolitan regions. On the face of it, this would seem an almost impossible task, for it is precisely here that land is hardest to come by and most dear. It always has been, however, and this is why there is such an imbalance today. Traditionally, state recreation programs have directed park acquisition to rural areas. Now that urban land costs have risen further yet, it can be argued, it is too late to shift the emphasis.

"But the metropolitan recreation problem cannot be solved somewhere else. Additional recreation land in the faraway places is needed, but the need is far more urgent close to home. Such acquisition, furthermore, can be highly economical. Land prices are higher near built-up areas, it is true, but for good reason: that is where the people are; and in terms of user benefits, \$1000-an-acre land close to people can be a better investment than \$100-an-acre land a weekend away."<sup>1</sup>

It is in the undeveloped fringe areas where county governments can make their most effective long-range parks and recreation contribu-

<sup>1</sup>Outdoor Recreation for America—The Metropolitan Area Page 81.

tions for today's rural areas become tomorrow's suburbs, which in turn become a part of the central city as municipal boundaries move outward.

In spite of many outstanding successes, if we are candid in evaluating the role that county governments have played in providing public parks and recreation facilities we must admit that there is a great deal more that can and should be done.

Fortunately at the national level several recent developments in the parks and recreation field have had a profound and beneficial effect on the nation's 3,043 counties.

In 1964, the first national congress devoted solely to county parks and recreation was held in Honolulu, Hawaii. This conference, attended by some 800 policymaking elected and appointed county officials and parks and recreation administrators, was sponsored by the National Association of Counties (NACO), which represents the nation's county governments.

As a result of this conference, a National Policy on County Parks and Recreation was officially adopted by NACO, and distributed to each of the nation's 3,043 county governing boards and the 44 state associations of counties. Prior to adoption, the rough draft of this policy was sent to some 25,000 county officials for review and comment. Where feasible, the 300 written comments received were incorporated in the final policy draft.

The National Association of Counties and the National Recreation and Park Association jointly established—and now sponsor—the NACO-NRPA County Parks and Recreation Service, which is currently being provided to some 380 counties in 46 states, and to 250 other agencies and organizations.

New publications have been printed and distributed to counties for the purpose of assisting in the establishment or expansion of county parks and recreation services. Two of the most recent booklets are, *County Parks and Recreation—A Basis for Action* and *County Action for Outdoor Recreation*.

The recent growth of the county parks and recreation movement is documented by the facts. In the decade ending in 1960 the number of county parks increased from 933 to 2,610; acreage doubled to 430,707 acres; and in the last half of the same decade, county park and recreation expenditures doubled—from \$67 million to \$122 million—and in my opinion this trend is not only continuing, but accelerating. However, we have only scratched the surface. In 1960, only 290 of the nation's 3,043 counties reported operating a parks and recreation program.

The growing interest and involvement of county officials in parks

and recreation throughout the nation is a good sign; however, many county officials, both elected and appointed, question whether county government has a legitimate obligation to provide parks and recreation lands, facilities, and programs.

Let me read a few excerpts from the National Policy, unanimously adopted by the 800 delegates in Honolulu, and by the governing board of the National Association of Counties.

"The special role of the county is to acquire, develop and maintain parks and to administer public recreation programs that will serve the needs of communities broader than the local neighborhood or municipality, but less than statewide or national scope.

"In addition, the county should plan and coordinate local neighborhood and community facilities with the cooperation of the cities, townships and other intra-county units, and should itself cooperate in state and federal planning and coordinative activities.

"Where there is no existing unit of local government except the county to provide needed local neighborhood or municipal facilities and programs, the county should provide such facilities and programs, utilizing county service districts, local assessments and other methods by which those benefitted will pay the cost. Coordination with local boards of education should include the park-school concept of building park sites adjacent to schools.

"County park and recreation programs should be financed principally through general taxation. This may be supplemented by such sources as general obligation and revenue bonding, donations of money, land and services from private individuals and groups, and user fees.

"Parks and recreation should be an integral element of all county land-use planning and zoning. Such planning and zoning should embrace not only areas to be acquired for the county park or recreation system, but maximum use should also be made of zoning and other regulatory powers to preserve open space, protect scenic values and otherwise enhance recreational opportunities in private developments.

"Counties should jealously protect existing park and recreation areas against both public and private encroachment, and should yield such areas for other purposes only upon the condition that areas lost are replaced by others of comparable value which serve the same population."

This policy, an expression of county officials throughout America, answers the question whether counties have a parks and recreation responsibility to their constituents.

I believe the future parks and recreation role of county governments will polarize in two directions:

(1) County responsibility will continue to be centered in the unincorporated areas, *i.e.* planning, acquisition, development, and administration of parks and recreation facilities and programs will be provided outside municipalities.

(2) County responsibility will be extended to cover all incorporated and unincorporated areas within the county. If one can look to the future with an objective viewpoint, I believe the countywide parks and recreation system offers many advantages.

An editorial in the November 29, 1965 issue of the *Washington Post* states the case quite clearly.

"Revitalized Counties . . .

"Dr. Robert G. Dixon Jr., professor of law at the George Washington University, sees revitalized county governments as the handiest tool available to our burgeoning urban areas. Many of the problems of the big metropolitan centers stem from the fact that they have no single government. Sprawling over city and county lines, and sometimes over state lines, they suffer acutely from splinteritis and no effective remedy has yet been devised.

"In the past the chance of finding any relief in county governments has been meager because they have usually been unrepresentative and archaic. With the Supreme Court's principle of equal population districts now being applied to local governments, however, county boards and councils are becoming more representative and more alert to their new responsibilities. So the best hope of obtaining good government for an area that is undergoing rapid urbanization may lie in modernization of the existing county government, which is already a going concern.

"Too many states encourage the growth of separate municipalities at the expense of the counties. But such suburban satellite cities are often poorly governed and lacking in essential services and planning. It makes more sense to discourage the birth and growth of suburban cities as such and to upgrade county governments. In effect the whole county thus becomes a single city instead of being a conglomeration of many weak, frustrated, expensive and unsatisfactory municipal governments.

"In his discussion of the problem in a symposium on 'Urban Problems and Prospects,' Dr. Dixon also placed some hope in the development of councils of local governments serving metropolitan areas. Sometimes the metropolitan council approach is the only practical one, when unalterable state lines divide a city, as in the case of Washington. Even in these situations, however, the problem can be

eased in very large measure if revitalized counties emerge as the new centers of power in suburbia."

However, regardless of the parks and recreation administrative structure used in a county, I believe there are three main areas where county government can and must provide leadership to meet the parks and recreation requirements of our present and future citizens if their needs are to be fulfilled. These are planning, land acquisition, and financing.

A. *Planning*—The lack of long-range comprehensive planning at the county level is the most critical parks and recreation problem facing local governments. The days of little or no planning or when haphazard guesswork, political considerations, and intergovernmental jealousies determined location, size, use, and administration of recreation lands and facilities must be ended. Such actions are detrimental to the public interest and are usually a waste of the taxpayers' monies. Long-range county planning should be projected for a minimum of 20 years, but preferably 50 to 75 years if possible. I believe the most important provision of the Land and Water Conservation Fund and of the Open Space Program is the requirement that a comprehensive plan must be prepared before a state or local government can qualify for these federal matching funds. Such a plan should serve as an official blueprint for all site location, acquisition and development projects of the affected jurisdiction.

The National Association of Counties, realizing the increasing importance of comprehensive county planning, will soon launch a nationwide planning assistance program to county governments. Each edition of five special planning guides will be distributed to 20,000 elected and appointed policy-making county officials throughout the country.

B. *Land Acquisition*—County governments serving as advance land acquisition agents for neighborhood, community, large urban and regional parks, usually can purchase, lease or otherwise acquire such sites at a fraction of the cost which cities will have to pay if acquisition is delayed until the site is annexed. Many counties now require that copies of all sub-division plats be sent to the Parks and Recreation Department for review. Thus, if officials determine a recreation site is needed in a particular community, they can make this fact known to the developer prior to and as a condition of final plat approval. In some cases, developers will donate parklands because of the tax benefits derived. In other situations purchase, lease, or other types of arrangements may be worked out between the county and the subdivider. In most states county parks are usually

transferred to city jurisdiction when sites are located in areas which have been annexed.

C. *Financing*—Since county government has the largest tax base of any unit of local government the advantage of utilizing this base for parks and recreation purposes is obvious. Although county officials usually complain about skyrocketing tax rates, a review of the financial condition of counties throughout the nation shows that they are in excellent standing in comparison to most city governments. I believe that there are two main reasons for this:

1. As incorporated limits expand, the cities become responsible for providing services formerly offered by the county—thus the county is relieved of this financial burden.

2. All property located in the county either in the unincorporated or the incorporated area is assessed the county property tax (the main source of revenue for county governments). In most regions, although the county collects taxes from property in both these locations, many county services are only provided to the unincorporated areas. This is an inequitable arrangement since city residents are taxed twice; however, services which are provided and financed on a countywide basis by county governments are fair and reasonable to city and non-city dwellers alike.

As we are all aware, financing is the cornerstone of any project. Though I have made a general statement that in comparison to cities, most county governments are in good financial shape, nearly all local governments are in need of additional sources of revenue.

The Open Space Program and the new Neighborhood Facilities Program of the Department of Housing and Urban Development and the Cropland Adjustment Program, administered by the Agricultural Stabilization and Conservation Service are excellent sources for 50 percent matching funds for acquisition and/or development projects.

The Land and Water Conservation Fund can provide one of the major sources of federal financial assistance to local governments. I used the term "can" since the determination of whether funds will be allocated to local governments and the amount of such funds is left to the discretion of the states.

Some states have adopted an informal attitude that these monies are to be used only for state projects; other states have adopted a more liberal attitude and are sharing the funds on an equal basis with local governments. If an accurate long-range statewide comprehensive outdoor recreation plan, documenting the requirements at the town, city, county, and state level, is to be prepared and implemented, fund monies will have to be more equally shared with local governments since the primary need according to the ORRRC Report and

President Johnson is in the urban areas. Current demands far exceed all federal monies available to local governments.

One of the major concerns of the President and the Congress is the critical need to rejuvenate our cities which in too many instances have become decayed, despoiled, unsightly and unhealthy areas of blight and blemish. We must remember that the suburbs and rural regions of today become tomorrow's cities. If county government fails to provide parks and recreation lands and facilities today, the cities will inherit the counties mistakes tomorrow when in most cases it will be too late and too costly to counteract these omissions.

#### DISCUSSION

DR. J. HAROLD SEVERAID (Sacramento State College): I would like to comment on something which probably Mr. Smithee knows but many of you do not know. This is the fact that Sacramento County in California has been implementing most of the things he was talking about.

One thing I would like to add to the record, because it might be of interest to some of the members here, is the comment from the report to the effect that a thousand dollars an acre is considered to be a fair price for land in the adjacent areas or near metropolitan communities.

I would like to point out the fact that our group in Sacramento, which is called the American Rivers Association, of which I happen to be president, has tried to demonstrate to the people that you can even go higher than this in terms of land cost and still make it worthwhile in the minds of the people involved.

Let me remind you of the fact that there are 4,800 square yards in an acre. That then means that you pay \$4,800 an acre for recreational land and still only pay one dollar for elbow room. In other words, standing with hands on hips and giving you enough room to recreate takes, for example, 15 square yards in connection with a family picnic table. Therefore, even at a cost as high as that, it is not out of line to buy recreational lands for this purpose.

In order to demonstrate this fact, we have, as an associational organization, started an "elbow room project," on which we took an option on a half a mile of riverfront land, and we are selling this to the public at one dollar per square yard. After we get this money collected and are halfway through our objective, we then will buy the land and turn it over to the county to be administered in perpetuity. We are trying to impress the people with the fact that they are getting a lot for their recreational dollar, because having once used the land, they have gotten their dollar's worth. On the other hand, it still is there forever.

I hope I have made myself clear with regard to this project. At any rate, we believe that this project can be used almost anywhere in the country to demonstrate the fact that the people, once they have seen this type of program, will no longer object to the high price that the county has to pay for recreational lands. I also think this will help in preserving natural beauty and recreational lands. I think this is one answer as to how the citizen can participate directly, because all it takes is any non-profit organization such as our own to serve as middle man. The organization can, in a sense, help the county government in precisely this manner because they then get the same tax benefit as if they were paying taxes. Therefore, they are in essence simply speeding up the process through this technique.

CHAIRMAN MORR: Thank you very much for what the Chair considers a significant contribution.

MR. JOHN S. GOTTSCHALK: This is a question that I have had rattling around in my mind and which I would like to ask Mr. Smithee. I would like to know if he has any suggestions, from the vantagepoint of his organization, as to how wildlife



resources and wildlife resource needs can best be identified and appreciated and integrated into a county or municipal park development, the point being, of course, that we usually think of these areas in terms of high-intensity use. Do you have any comment on that?

MR. SMITHEE: I might mention that I was one of the members when this policy was adopted, and this has been an area which has not been traditionally filled by county governments. This is the area, of course, of utilization of game refuges and similar types of facilities.

I think the county government sees its role as that of providing day-use facilities as contrasted with overnight facilities, such as those on state and federal areas. The secret, I think, in utilizing this lies with two organizations. One is the National Association of Counties and the other the County Planners. I know that, in the services we provide the county governments, most of the requests we get are from county planners. In the criteria for a county park and recreation system, the most important person is the planner, because his initial thoughts that he puts down on paper usually become the official plans of the Board of Supervisors. In other words, those are the ones that determine the future course of the park and recreational development by the county. Of course, this varies to quite a degree over the country. In other words, in some areas you have strictly urban counties, and in others you have strictly rural counties. I think that the National Association of Counties works through 44 state affiliates. We also involve the planners and state planning associations, the national planning associations and the state liaison agencies responsible for administering land and water conservation.

Now, as to the way these programs evolve, they are usually started out by somebody going to a citizens group and saying, "Why can't we have a place for Johnny to play?" This is the way these programs have usually evolved in the past and with the new emphasis on parks and recreation, the important factor is identifying the county's responsibilities and then establishing a system and documenting the responsibility.

I don't know whether I am answering your question but I would say that this would be the area to talk to.

MR. GOTTSCHALK: I don't know if you are answering my question either, but I think your points were enlightening in relation to this subject.

Frankly, the thing that bothers me is that we have a classic example of the Cook County Forest Preserve as an area that was set aside a long time ago to provide a great variety of recreational opportunity for the people in that area. It also has put a lot of emphasis on the appreciation of wildlife as a part of its program. This is something that many of us have been concerned about.

Now, my question is this—Why has not this type of program struck fire, so to speak, across the whole country? Why don't we see more of this sort of thing? I know personally of several other examples, but it isn't something that many communities apparently are interested in pursuing.

MR. SMITHEE: I think this can be summed up by the fact that up to just a few years ago very few county boards were enlightened to the point where they even saw a necessity for parks and recreation programs or even a park system. This has been because the state legislatures have traditionally been controlled by the small counties, and home rule as such for county governments is relatively limited. This is a new concept. I think you are going to find that it is catching on. In fact, most of the new concepts that I am acquainted with in county government are leaning very, very heavily towards the regional park concept. This is the idea of preserving the flora and fauna in its natural state.

I think it is a matter of educating the local county government that there is a need for this type of thing and, of course, the ideal agencies to do this are the National Association of Counties, the planners, and our own organization, the National Recreation and Park Association.

One of the basic requirements in connection with all of our county studies is the establishment of what we call regional parks, which are retained almost in their entirety in the natural state and utilized for camping, nature study, etc.

Those creating departments now receive pressure from both sides. In other words, they get pressure from urban areas but, on the other hand, there is also a very definite awakening to the need of acquiring and preserving the large regional park areas and game refuges ideal for this purpose.

I think it is merely a matter of working out a joint agreement with these agencies.

MR. GOTTSCHALK: Now then, I do not want to continue this beyond this one question.

How can the wildlife-oriented conservation agencies help you in trying to put these things across? Do you have somebody on your Washington staff we could work with and try to do a little more effective job? I think this is an extremely important thing and, therefore, do you have suggestions as to how we could be of more aid? If you do, I would appreciate knowing about them.

MR. SMITHEE: To answer your question—yes, we do have a staff member. It is I. Also, we would be very happy to work closely with you.

We have a service now going out to 380 counties. I would say that 250 of these have no program or an insignificant program and possibly a budget of about \$3,500 a year. Therefore, we have here a golden opportunity. We would very much like to work closely with you.

CHAIRMAN MORR: Thank you very much, John.

I believe we have made some progress here today. I think we have pointed out, by this line of inquiry, that we have a need for education, for aid and assistance, perhaps, from state and federal agencies, and associations who are interested in wildlife resources.

I should like to comment further that the need recognized by your association, sir, for strengthening zoning and planning functions within urban areas is one to which we direct your further attention. There is a need for retention of open spaces which then, in turn, may be utilized for the preservation and propagation of our wildlife resources, especially if the enjoyment of our people throughout this land might be accomplished.

MR. COLVIN (Iowa): I might comment that in 1955 our legislature passed a special bill making it possible that, upon a petition being signed and presented by a certain number of people in the county, they could then get a proposal on the ballot. Since that time 83 of our 99 counties have actually established such a county conservation board and they are providing for purchase not only for lands for hunting and fishing but for camping and picnicking. In other words, they are providing for lifetime recreational activities. Also, some of the areas purchased have been special study areas for schools. Some of the areas purchased have also been set aside as nature preserves—you name it—and the possibility is also there for almost anything else along this line. We feel very lucky in that we now have funds that are coming in. These funds, plus funds donated on a matching basis, have now put us in an excellent position of being ready for further expansion along this line. We think it is a wonderful opportunity.

CHAIRMAN MORR: I would like to direct your attention to the Iowa program because it is just about as unique in this field as the legislation in Nebraska.

## ELEMENTS OF SUCCESSFUL STATE PLANS

M. O. STEEN

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In my view, a successful plan must be more than an academic exercise that measures needs in relation to supply and demand. It must be more than a mathematical manipulation of data and statistics. We deal with both people and resources, and the variables are countless. Planning must be tempered with practical judgment—judgment based on the realities of life as we find them in any given state. Most important of all, a successful plan must be oriented to action. Plans that cannot be implemented have little value. A successful plan must lead to a successful action program.

Economic reality is the key to a successful action program. Public action is limited to available funding; private action is based on the profit motive. Here, as elsewhere, "it takes money to make the mare go." A successful plan must be an economic plan as well as a recreation plan. Funding of public action must be on a stable and long-term basis. Among other factors, such a plan should weigh carefully the impact of the public program upon private action. It is possible to encourage or discourage private investment through public action.

I believe it safe to say that most state comprehensive plans are the result of requirements of the Land and Water Conservation Fund Act. Each state must have a plan which meets these requirements before becoming eligible for grants-in-aid. As a consequence, the tendency has been to hastily develop plans which meet the minimum requirements of the Act rather than the long-range problems of the state.

Outdoor recreation problems vary widely across the United States. The approach and methodology will vary from state to state; each must gear the planning effort to its individual situation. Of necessity, guidelines laid down by the Bureau of Outdoor Recreation must be followed, but we have found that these guidelines provide sufficient latitude to plan on the basis of state needs. Where there is conflict, consultation invariably develops a practical solution.

BOR has given short-term approval to many state plans, none of which cover more than 26 months. As indicated previously, incomplete plans are the result of urgency and lack of previous long-term planning. I would warn against repeated short-term actions, however, since this course of action will delay and discourage long-range planning. This is retrogressive action. One of the great deficiencies common to state government is the lack of long-range planning—the

year-by-year or biennium-to-biennium approach. A plan operating on this basis cannot possibly be a good plan.

Coordination is a must in successful planning. Many federal, state, and local agencies have responsibilities in the field of outdoor recreation. If a truly comprehensive plan is to be developed, coordination of the planning and action programs of these various agencies is essential. Again, the problems faced will vary from state to state.

In Nebraska, the problems of coordination at the state level are relatively simple. Our agency, the Game, Forestation and Parks Commission, is responsible for virtually all phases of outdoor recreation, including planning and administration under the Land and Water Conservation Fund Act. I know, however, that this is not the situation in many states. I suggest that coordination is the responsibility of each and every agency involved, and particularly the unit that administers the Land and Water Conservation Fund Act in the state.

Coordination of state planning efforts should not be limited to those agencies which have outdoor recreation as their primary responsibility. Other state agencies may also have impact on outdoor recreation programs. These agencies must be brought in on the planning, and probably the action, for the best results. As an example of coordination where one might least expect it, in Nebraska we have what is probably the nation's outstanding example of the contribution federal and state road agencies have so far made to esthetics and recreation.

Interstate 80 traverses, in part, the Platte River Valley, paralleling the river proper. This valley is a mighty aquifer, with vast underground storage of Platte River waters in the uniform sand and gravel deposits that lie miles wide and very deep beneath the surface soils all along this valley. Ground water stands at the elevation of the river's flow.

In cooperation with the Nebraska Road Department and with the blessing of the U.S. Bureau of Roads, we have developed a chain of lakes all along Interstate 80 in the Platte River Valley. In excavating fill for the roadbed some 75 crystal-clear lakes, complete with white sand beaches, were created at no added construction costs along 150 miles of this major transcontinental highway. We will landscape and develop these lakes for the use and enjoyment of the interstate travelers as well as our own citizens. Land and Water Conservation funds will contribute substantially to this development. Coordination can work wonders.

In the early phases of a planning program, it is important to develop preliminary plans that will serve as an organizational base

and guide for future planning efforts. The state, of course, must be the basic unit of planning, but for large states it is desirable to use sub-units as a basis for regional planning.

Delineation of regional planning units will vary from state to state, based on their individual problems. But the purpose of the total planning effort is to identify outdoor recreation needs of the people and to develop a scheme to meet these needs, including the preservation and development of related resources. Thus it is logical to develop a scheme for regional planning units which emphasizes a user-oriented concept for both urban and non-urban facilities. This is especially true for Nebraska.

Many of the existing problems in outdoor recreation result from poor distribution of resources in relation to the people. Nationwide, the prevalent problem, as pointed out by the Outdoor Recreation Resources Review Commission, is not one of total acres devoted to outdoor recreation but one of effective acres (ORRRC, 1962). Most of the outdoor recreation opportunity is located in sparsely populated areas not readily available to most of the population. Essentially, the same problem exists in Nebraska.

Population distribution and density are extremely irregular. In four contiguous counties of eastern Nebraska, 36 percent of the state population resides on 2.5 percent of the area. The population of this small tract exceeds the population of 67 other counties to the west. Population density by counties varies from less than one person per square mile to more than 1,000 people per square mile. Most of the existing recreation activities are located in the western two-thirds of the state, beyond day-use range of the metropolitan areas.

As a result of rural-urban shifts in population, future trends in demand for outdoor recreation will vary within the state. Many other social and economic variables will contribute to this variation in regional demand.

In consideration of the user-oriented concept for outdoor recreation planning and the irregular population distribution and other social and economic variables, socio-economic areas were defined and adopted as regional planning units.

This concept was based on the idea that socio-economic regions occur in the state which include a central city and a large enough natural economic area surrounding it to support an acceptable level of facilities, goods and services (Ottozon *et al.*, 1965). The central city must be large enough and diverse enough to provide the people of an area with all that they require in the course of daily living.

Smaller towns within such an economic area become satellites and serve certain specialized functions such as places of residence for

retired people and workers that commute to the central city. Their function might be considered similar to that of a suburban area of a large city.

Identification of the socio-economic areas in Nebraska was based on the following criteria:

- (1) The central city should have a population of 12,000 or more;
- (2) The area should have a population of 50,000 or more; and
- (3) The area should not exceed 10,000 square miles in size.

Actual delineation of the 14 areas of Nebraska was made on the basis of the percentage of county residents who had always lived in their given residence as provided by the 1960 census. In almost every case, the percentage was highest in the border counties and lowest in the counties containing the central city. This would indicate a more dynamic population near the central city and that long-run population shifts occurred within the approximate pattern of the delineated areas. It follows that such shifts were motivated by economic and social forces.

The system developed in Nebraska is viewed as flexible at the present time. Additional study may result in the realignment of certain socio-economic areas with sub-units identified within each area. The types of outdoor recreation services which can be provided by the central cities and its satellites can be determined. Thus, grant-in-aid programs, whether federal or state, can be directed to solving the problems of the total region in the most efficient manner possible.

This concept may not be applicable in other states, but for large states with substantial differences in population, social and economic conditions, a similar approach may have merit. We believe the delineation of socio-economic areas provides an excellent base for future planning efforts in Nebraska—one for which planning can be oriented to people and their problems on the soundest possible basis.

Again I repeat that a plan must be designed to solve the social and economic problems related to outdoor recreation if it is to be successful. Planning for people—long-term planning for their social needs and their economic welfare must be the central theme of any good plan.

Finally, ultimate success of the plan depends on how well it is implemented. The principal problems of successful implementation are those of funding and authorization, both of which the state legislatures must provide. Success in this phase will depend largely on a receptive legislature and an informed public.

Adequate communication between the action agency, the executive branch, the legislature and the people is essential. The administrator

is in the position of a salesman. Plans are his product—ideas that have been developed by adequate and imaginative planning.

In Nebraska these lines of communication have been developed and maintained. We have developed and sold sound plans for outdoor recreation and resource management over the years. We try first to reach the people, then the executive department and finally the legislature. All have been fully and frankly informed of potentials and program needs. We have never hesitated to point out potentials, needs, and economic opportunities to any and all who will listen.

Our experience and studies over the years demonstrated that many of the critical outdoor recreation needs in Nebraska are at the local level—the counties and municipalities. Financing is a major problem with political subdivisions.

We took this and related problems to our legislature and proposed that matching money be provided through the cigarette tax. This source of revenue has advantages, among which is that of remaining stable over the years, an essential feature of a successful program. We recommended that the Game, Forestation and Parks Commission be authorized to make 25 percent state grants-in-aid of our cigarette tax revenues.

In this manner we have been able to stimulate action by political subdivisions. State grant-in-aid help met the principal problem of political subdivisions—the funding problem. While we are still in the first year of the program, it is obvious that this approach is highly successful.

To date 95 political subdivisions have submitted project proposals and/or indicated they wish to participate. Projects from 45 municipalities and from three counties have already been programmed for financing. By law we provided that forty percent of all federal funds be allocated to political subdivisions. As of today, all anticipated funds from this source and for this purpose are already programmed up to Fiscal Year 1970. Additional projects are being submitted daily—projects on which we cannot take immediate action for lack of funds.

#### SUMMARY

The principal elements of a successful state plan are summarized below.

A successful comprehensive state outdoor recreation plan is one that stimulates a well-financed action program and provides adequate guidelines to meet, in the most efficient manner possible, present and future needs of the people in the total field of outdoor recreation.

1. A plan cannot be successful unless it is implemented—translated

into successful action. Economics determine results. Public action depends on funding, private action on profits. Funding of public action should be on a stable and long-term basis.

2. Planning must be recognized as a desirable and necessary phase of the over-all state program. To be successful, the plan must be developed as a state document which will meet the long-range needs of the people in outdoor recreation, not solely to meet the minimum requirements of a federal grant-in-aid program.

3. Coordination with the many federal, state and local agencies which have responsibilities for outdoor recreation is one of the most critical phases of a successful planning effort.

The problems of coordination are simplified if the responsibility for all phases of outdoor recreation are vested in one agency.

With the increasing number of planning efforts by federal, state and local agencies, it is becoming more difficult to coordinate all the activities. Yet these planning efforts should yield comparable recommendations if they are to be successful in stimulating and gaining support for an action program. It is highly desirable to resolve conflicts which may arise in the various planning efforts while still in the planning stage—not after the plan is published.

4. In the early phases of a planning program, it is important to develop preliminary plans that will serve as an organizational base and guide for future planning efforts. The purpose of the total planning effort is to identify outdoor recreation needs of the people and to develop a scheme to meet these needs. Thus planning is user-oriented. Considering the user-oriented concept and the widely varying social and economic conditions, regional planning units were delineated in Nebraska based on social and economic factors. It is believed that these areas will provide an excellent base for future planning efforts and one for which planning can be oriented to the people and their problems on a regional basis.

5. The ultimate success of a plan depends on how well it is implemented. Normally the critical problem of implementation is adequate financing. If this problem is to be solved, the administrator and his staff must be able to sell the ideas which have been developed through sound planning. Communication between the action agency, the people, the executive branch, and the legislature is essential.

Implementation of outdoor recreation projects by political subdivisions can be greatly stimulated by the addition of state grants-in-aid.

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## DISCUSSION

CHAIRMAN MORR: Thank you very much, Mr. Steen, for that excellent presentation.

MR. RUPERT CUTLER (Wilderness Society): While your state recreation plans must be user-oriented, can you possibly allude also to the fact that these plans should not only recognize areas of high natural value and protect resources but, on the other hand, also provide public access and recreational facilities?

MR. STEEN: Well, as I indicated in my talk, the conditions vary so widely across the nation that it is difficult to lay down exact and precise rules for all sets of conditions.

Again, the development of this approach, I believe, is greatly simplified in a case like ours, where we have all the responsibility and all activities under one direction. Certainly, in our program we recognize and preserve and develop the things you just touched upon. If there is not the situation in the state, then, of course, there is much more need for coordination for pulling things together. I should say that perhaps the development of a multiple-use, multiple-objective approach would be in order, if this is possible. In our state, for example, we purchase land and we may purchase it either for day-use purposes or for state park purposes. We may also purchase it for wildlife areas, and we may purchase it to preserve some historic area. However, we do not confine its use to the one particular or primary purpose. We have recreational areas but they are also wildlife areas. The people who go to our parks can see deer and squirrel and rabbit and quail and pheasant and wildlife galore right on or in the immediate vicinity of the park. Our situation, of course, is different—it is unique. The same situation may not exist in your state or probably in other states in the central United States. This is something that relates back to what I said originally—that a successful plan must be based on the realities of life as they exist in each state. But it must also be based on coordination and on total effort to achieve the greatest amount of good for the greatest number of people and not on some narrow, limited approach.

Does that answer your question?

MR. CUTLER: Thank you. I simply wanted to point out that in the state recreation plans we might hope that diversity of recreational opportunity is afforded. In other words, you may have some areas of low density recreational use in connection with which people can get away from other people. As you know, as both vehicles and population increase, it is going to be more difficult to do this without some really pointed and conscious efforts in this direction.

MR. STEEN: A comprehensive plan would include all of these things. It is a user-oriented thing but, on the other hand, you have citizens who want to go to a wilderness area. In our plan we have wilderness areas, we have intensively used areas, we have day-use areas. We have the whole gamut and we use each area that we need for as many purposes as apply to them. Of course, we cannot have paved roads in the wilderness area but we certainly can have wildlife and all the other things that are desirable.

MR. WILLIAM TOWELL (Missouri): I would like to commend Mr. Steen and the State of Nebraska for this most imaginative plan that I have heard yet in the development of these 150 lakes along Interstate Highway 80. This is probably the most outstanding example, I think, of coordination between highway development and recreation people that has come to my attention. I would like to know the average size of these lakes and depths anticipated in connection with their use.

MR. STEEN: Well, Bill, they vary in size. As you know, we had this great big valley with prehistoric deposits of sand and gravel many miles wide and two or three hundred feet deep. We have an underground lake which stores tremendous quantities of water and it is sustained by the flow of the river. The ground water stands at the same elevation as the river. If the ground water is within three to five feet of the surface anywhere in that area, then when you dig down two to four feet for fill, you are in water. The original concept, of course, was that we were going to have to scalp half the landscape to get enough fill to build a four-lane

interstate highway. However, we proposed to the highway department and received concurrence of the Bureau of Public Roads that instead of tying up all the landscape and leaving a pit there, that they get their fill by going down instead of out, which they were able to do. In other words, they did it by dredging and, finally, they discovered that by sinking sand points around the pit and putting pumps on them they could draw the water level down sufficiently so that they could use other mechanical devices for taking out the fill.

We built lakes right up that valley for the whole distance there. In fact, there are many beautiful lakes there. There are some 25 to 50 acres in each of them. As I say, these are beautiful things and when we get them landscaped they will get more use. In fact our people are already using them, although they are not yet developed.

We also have built, at stated intervals along this highway with one or more of these lakes as a centerpiece, day-use areas for our own people. We have also put in them wayside parks for the traveler. In fact, we have chosen to call them "road ranches" because that is the name that was applied to the stopping at a place alongside the covered wagon trails in the old Oregon Trail days.

CHAIRMAN MORR: There is time for one more question if there is one.

MR. ROBERT RAISCH (Indiana Department of Natural Resources): I would also like to compliment you on a well organized paper and for the presentation of your program.

I have a question with regard to county planning. I wonder how you feel about this.

We believe that county, or perhaps in some cases multi-county or inter-county planning, is desirable and perhaps should be requisite to final project approval, not only to insure the coordination between communities within a county or between counties but also to give the county a natural place in updating our own planning and supplementing it.

What provision do you have for this or what is your feeling with respect to it?

MR. STEEN: Well, here again we have a unique condition. We have 93 counties in the state. Most of them are sparsely populated. They are not highly organized and many of them have not gotten into the recreational field. But, nevertheless, we have encouraged and have developed in several cases a coordinated effort between a municipality and a county. It is a little difficult for me to relate what we do in our state to the conditions that exist in a densely populated state because conditions are not the same.

## PROBLEMS OF STATE IMPLEMENTATION

CHARLES D. HARRIS

*Department of Conservation, Lansing, Michigan*

I suppose the only general statement that can be made about state implementation of plans developed to meet requirements of the Land and Water Conservation Fund Act is that every state will do it differently. Inane as it may sound, that is actually a statement of some significance. It reflects the basic philosophy of the Act, which puts the states in the saddle. There are federal guidelines, to be sure, but the recreation plans we draft will be our plans. Implementation and administration will be our responsibility.

This is good. It's a shining example of how we in Michigan think the federal-state relationship should work. It's essential that the states be cooperating partners in the planning and shaping of federal recreation programs, to assure that those programs serve the particular needs of each state. This the Land and Water Conservation Fund Act does. It gives us the ball, and puts it squarely up to us whether we carry or fumble it.

As the agency designated to administer the Act in Michigan, our Department of Conservation is fortunate. Ours is a broad department. Our responsibilities include not only fish and game but also parks, forests, water, minerals—the full spectrum of natural resources. Within the past year we have even been assigned to help local units with their community recreation and cultural arts programs. Thus, no matter what our statewide recreation plan may call for or how the Land and Water Fund monies are divided, some aspect of our total department program will be helped.

Those of you whose agencies are oriented primarily toward fish and wildlife may be taking a less cheerful view. I am sure you anticipate that most of the money granted to state and local governments from the Fund will be put into parks, and I am sure you are right. Parks will be the chief beneficiary. This Act, after all, is the first federal-aid program which includes parks. On the other hand, game and fish have enjoyed the blessings of the Pittman-Robertson and Dingell-Johnson programs for many, many years, and you are to be commended for this, as it was by your action they were established and have meant so much to fish and wildlife programs. But it is only recently that parks and recreation people have been successful in arousing national interests sufficient to get also into the federal-aid picture, and I am sure you will agree they need this help the same as you have and now need help from the P-R and D-J programs.

But—and this is a very important but—that does not mean game

and fish and hunting and fishing have no place in the program. The Act requires that state planning be comprehensive, that it embrace all aspects of outdoor recreation. No definition of outdoor recreation that I have ever known fails to include hunting and fishing as integral components. We have given them major emphasis in the interim Michigan plan we submitted to the Bureau of Outdoor Recreation. The Bureau's approval of the plan means to us that we were right in our judgment. We would have been shocked by any contrary determination.

These recreation plans, remember, are the responsibility of the states. If any state plan ignores fish and wildlife values, it is clear where the blame belongs. It lies squarely at the doorstep of that state's fish and wildlife administrators, and the customers they represent.

If a fish and game agency has been designated to draw up the plan for your state, the odds are that fish and game interests have a prominent place in it. We know, however, that in many states—possibly even in a majority—some agency other than the department of conservation or department of natural resources has been assigned the planning job. It may be the agency responsible for parks, economic development, or highways. It may be a state planning office, a budget department, or an inter-agency committee. In such situations there is a real danger that fish and wildlife may be slighted unless fish and wildlife administrators make it their business to see that their interests are represented. Although we have not experienced it in Michigan, we can certainly appreciate that this remoteness for the planning function could be a real problem.

I suggest there is only one way to cope with such a problem. That is to knock on the door of the planning agency, whatever it is, and invite yourself in. Chances are excellent that you will be welcome. Planners almost always are looking for assistance and, more important, ideas. Even if your state has already completed its interim plan to qualify for initial Land and Water Fund grants, you still have time. The Act provides, in fact requires, that amendments and refinements be made to the interim plan, that it be maintained on a current basis.

Fish and wildlife administrators ought to be especially alert for opportunities to integrate hunting and fishing into plans for parks and recreation areas. By custom, most state parks and all national parks are closed to hunting. This is an unnecessary restriction in many cases. In Michigan nearly 90 percent of our state park and recreation area lands are not only open to hunting but are managed directly for the production of game. Our experience is that hunting is

entirely compatible with other park uses. It is one of the activities that parks should be planned for.

Where parks include lakes, streams or impoundments, provision can and should be made for management of the fish resources in those waters for the benefit of anglers. Fishing, like hunting, is a perfectly legitimate recreational use of parks. In particular, care should be taken in the planning of beaches and waterfront parking lots to avoid destruction of fish spawning grounds and waterfowl habitat. Parks planners may not have the ability to recognize such values. It is up to fish and game men to point them out, and fight for them if need be.

A related problem, and an increasingly serious one, is pressure to convert into intensive use lands and waters purchased and dedicated for hunting and fishing. This pressure is growing, particularly where hunting and fishing sites are located in or near centers of large and expanding population. Costs of buying new lands for parks in such areas are usually high, so the temptation beckons to "solve" the problem by usurping hunting land and fishing water. Here is a challenge the fish and game administrator cannot ignore. His duty is to protect the rights of the hunter and fisherman. At the very least he should insist that such conversion be based on the principle of equal-value exchange rather than outright surrender. At the same time he must be flexible enough to recognize that hunting and fishing areas almost always can be opened to other kinds of recreation without destroying their primary uses.

The most important single implication of the Land and Water Conservation Fund Act is not the money that it makes available. It is the requirement that we plan, that we think big. The comprehensive plan for each state is not to be simply a plan for spending Land and Water Act funds. It is to be a plan for recreation in the broadest sense, regardless of who is to carry out what specific projects or the source of money to be pursued.

If the plan is drawn only to the scale of expected Land and Water Conservation grants, then we can predict with certainty that total recreation needs, including those of game and fish, will not be met. Most of the money to implement a truly comprehensive plan will have to come from state, local, and private sources. All the Land and Water Fund is intended to do is prime the pump.

Let me illustrate with some figures from our preliminary ten-year plan for Michigan. That plan estimates a total money need of between \$450,000,000 and \$800,000,000. From the Land and Water Fund we expect to receive at most \$40,000,000, perhaps less. We will need up to twenty times what the Fund will provide, and up to ten times what it will furnish even when matched with state and local dollars.

Where will the rest of the money come from? Much of it will flow from the traditional federal, state, and local sources from which outdoor recreation derives its financing now. Private capital will furnish what I hope and believe will be a steadily increasing amount, as the profit-making possibilities of private recreational enterprise become more generally recognized. Still other sources will no doubt have to be developed.

Money will not be the only problem, of course, although it's always a tough one. We see as a major difficulty the recruitment of competent outdoor recreation planners. The existing supply of these professional specialists is short, and it will grow worse as competition for them increases.

Even if you get all the planners you need—and you probably won't—you must still grapple with the headache-packed problem of priorities. How are you going to decide which projects should come first and which should wait? How will you determine the relative importance of state-level versus local-level needs? How should you allocate the money you have, knowing there won't be nearly enough to go around?

I wish we had answers to those questions, but we don't—yet. We are working on them. I am sure that whatever criteria we come up with, no matter how rational and objective, will be challenged. Whoever administers the Land and Water Conservation Fund in his state is not likely to win many popularity contests.

Finally, let me offer a few words of friendly criticism—and advice—to you fish and wildlife administrators. In spite of the federal-aid assistance which has been your advantage for many years, you people have fallen rather badly behind in this long-range planning game. With few exceptions you are johnny-come-latelies who have let your opposite numbers in the parks and recreation field get the jump on you.

It isn't too late for you to catch up, but you had better get moving. Unless I am badly mistaken, the first places in the lineup for funds will be taken by those who have done the long-range planning job best. It's not enough to know what you would like to do this year or next year after that. You should be looking at least ten years ahead.

Legislatures, federal agencies and other sources of financing are more and more demanding well-conceived, well-documented plans as a condition of untying the purse-strings. You are going to have to demonstrate and justify your needs on the basis of systematically collected evidence imaginatively prepared and presented. If you haven't been doing this, and most of you haven't, I urge you to get going.

## DISCUSSION

MR. WILLIAM TOWELL (Missouri): I am very pleased to see Steen come to the defense of hunting and fishing in this new outdoor recreation picture. I have been somewhat concerned about hunting and fishing taking a back seat behind many other new-found types of outdoor recreational developments.

Now, a friend of mine thought about this same thing recently when he said that he likewise was disturbed about the references to outdoor recreation, including hunting and fishing. He said that if the state directors are on their toes that they will start turning this around and mention hunting, fishing and other forms of outdoor recreation.

I think it is imperative that we keep outdoor recreation oriented to resources, to rivers, to lakes, to forests, and not let it become entirely an asphalt playground.

CHAIRMAN MORR: Thank you very much.

I would like to say that our view in Ohio is much the same. Our own departmental policy might be of interest here. In our plans for acquisition and retention of significant natural areas, which is a specific part of our state program. We meet with the state chapters of nature conservancy groups and our university-oriented biological survey. We meet also, from time to time, with conservation organizations and with sportsmen's organizations, and we try to compromise. We recognize the needs of one another and also one another's demands.

I think Bill's contribution—that of hunting, fishing and other outdoor opportunities—might well be the theme of our work.

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## POTENTIAL EFFECTS OF THE LAND AND WATER CONSERVATION FUND ON WILDLIFE

JOHN S. GOTTSCHALK

*Director, Bureau of Sport Fisheries and Wildlife, Washington, D.C.*

It is customary for panel members to begin their dissertations with a disclaimer that nothing in their paper bears any relationship to its title. My remarks are no exception.

I do not know what the potential effects of the Land and Water Conservation Fund Act on wildlife will be. But I do have a few ideas about what that Act will—or will not—do if the professional game and fish managers and conservationists do—or do not—respond to the public needs and demands represented by the Act.

Essentially, of course, the Land and Water Conservation Fund gives us a new tool to use in the conservation battle. But a tool without its master is a toy. Unless we use it with wisdom and finesse, our new Act will help us little.

The problems besetting wildlife conservation in 1966 are reasonably clear and have scarcely changed in fundamentals in recent decades. No new piece of legislation will make these problems or their solutions differ.

We need habitat. Not just acres or square miles, but habitat made viable and productive within its ultimate limits by a factor of quality.

Air and water and soil robbed of the capabilities of life by pollution or mismanagement are of no significance.

We need access. Except in wilderness situations, habitat, no matter how productive, is not serving a useful purpose unless it is available. Even in wilderness, popular concern requires that we refrain from employing the "gun fired in the empty, soundproof room" conundrum. And we must be able to walk or paddle into the most sequestered cloister of the forest primeval, if for no other reason than to be able to tell others it exists.

We need know-how. As old as science or older, this hoary euphemism nevertheless commands greater acceptance every year. We cannot begin to solve the problems of wildlife conservation on a planet rapidly becoming overcrowded and even hungrier than we here in opulent America realize, without vastly more sophisticated philosophies, techniques, and managerial capabilities.

And we need public support. If I ever, in my professional career in this business of conservation administration, had any doubts about this facet of the modern conservation needs/solutions equations, it has been effectively dispelled in the brief time that I have had to appreciate the growing obstacles of indifference, exploitiveness, and petty selfishness, which combine to thwart so many of our altruistic efforts.

Obviously, public support is what is required to get more healthy habitat, and access to it, and scientific know-how.

But what does all this have to do with wildlife and the Land and Water Conservation Fund Act?

The Land and Water Conservation Fund can be a great boon to fish and wildlife interests, but only if we adjust our thinking and our actions to it. The program is, of course, designed to meet the demands of people seeking outdoor recreation—that is, outdoor recreation in general. This means *all* of the people with their added disposable income and more leisure time, swarming to the out-of-doors for recreation experiences. These include fishing and hunting, but they also include a great many other forms of recreational enjoyment of wildlife. We who are in the fish and wildlife management field must take note of this flood tide of interest and adjust our programs accordingly. A policy of maintaining our programs solely for those who buy fishing and hunting licenses, rather than for those who seek outdoor recreation but who don't buy licenses, will not get the most for wildlife from the Land and Water Conservation Fund Act. This, I believe, should be the main point of concern by fish and game managers if they are to realize the potential for them in the Land and Water Conservation Fund



It is said that survival is the primary concern of us all—and under this swell of interest for recreational development, now is the time for wildlife interests to act—or be left at the post.

Fish and wildlife will share and benefit when we have the facts to justify a larger role. To get the facts we need increased research—and I don't mean life history or population dynamic studies—as valuable as they are for management purposes. We need to know our *customer* better. We need to study the markets—beyond the usual consumptive public. Who is our public—and what do they really want—and what are they willing to pay? We need to know!

Fish and wildlife will share and benefit when we not only cultivate more widely the broad support we already have, but develop an even wider public backing. For example, what have we really done to foster the landowner's interests in fish and wildlife matters? What incentive does the landowner have to do as we wish? It has long been a great American tradition that people are permitted to hunt and fish without charge. Fish and game are legally common property, and the sportsmen generally arch their backs at the thought of being charged for recreational hunting and fishing for what is legally their own property. There is nothing immoral in charging an entrance or trespass fee, or a fee for the use of specific facilities. We may as well accustom ourselves to paying such fees, whether the lands involved are public or private. And, if the result is to create a profit incentive for private landowners, it could even mean vastly improved game management on such lands. This, incidentally, may be one of the new directions in immediate prospect for our field.

There are several practical respects in which fish and game managers can contribute substantially to the success of the Fund Act and, at the same time, help their own program immeasurably. The first point of interest and influence, aside from the designation of the state contact agency, is the preparation of comprehensive, statewide plans. Most of the state plans now before the Bureau of Outdoor Recreation are preliminary in nature and subject to further refinement. In short, there is still time to make fish and wildlife resource needs known, if they are not already known. I am certain you will agree that fish and wildlife have an important place which must be fully recognized in these plans.

There are many fine examples which could be cited of how this multipurpose planning is being done. For example, I recently noted that the Utah Fish and Game Department and the State Recreation Commission are drawing up the plans for that state. The work under the oversight of a planning committee, on which the late Director Crane was represented along with the State Planning Coordinator. As

a part of this effort, the University of Utah has undertaken the task of researching recreational demand patterns by residents and nonresidents. The University researchers found, interestingly, that participation rates of residents in fishing and hunting in Utah are 32 percent and 45 percent, respectively, above national averages. Another substantial proportion of people who do *not* hunt or fish indicated that they would like to do so.

These are facts that are important in building and selling recreation plans that truly meet the real needs of people. Hunting, fishing, bird watching, and nature observation are among the most popular of outdoor recreational pursuits, and these should be important considerations in developing a state plan. Having such facts can materially assist our efforts in providing more facilities. We should welcome their collection and dissemination.

The factor of gathering the potential support we have is tremendously important. It is true that sportsmen were the early supporters of many conservation efforts and are today the bulwark of the conservation movement—but they are no longer the only ones who have a special interest. Have you considered the contribution that the non-consumers could make toward your coordinated programs? There is no longer any valid reason why the appropriation of general tax revenues cannot be called upon for cost-sharing fish and wildlife developments, as well as other recreational projects. But our horizons will have to be expanded—we will have to do something for these “non-consumers” to hold their support. Are you making any plans for developments near urban areas? The latent interest in fish and wildlife among the general public is boundless. *This public can be our public.*

Fish and wildlife will share and benefit when the states universally become engaged in the preparation of the comprehensive, statewide recreation plans. Look at what some other states have already accomplished!

Illinois, for example, contemplates a five-year program calling for \$193,750,000 of federal, state, and local funds, about \$21,750,000 of which is expected from the Conservation Fund. Fish and wildlife developments for *people* are definitely included.

The Virginia Comprehensive Plan includes plans of the Commission of Game and Inland Fisheries for a \$400,000 annual expenditure of “fund” money for public fishing lakes, boat-launching ramps, and hunting lands in the populous eastern sections of the state.

In the Western States, public lands often are plentiful, but facilities and access points are needed. Montana has done an outstanding job of coordinating its state plan and has already had

several projects approved for the rehabilitation of old state parks with access roads, etc., for the fishing and general public.

Fish and wildlife will share and benefit when you become actively engaged in the over-all coordination of your state's outdoor recreation effort. It isn't always easy, but seek out and exploit common goals and interests. Without a doubt, the many diverse recreational interests will find that they can get more land and facilities for the public through joint action than by each pursuing an independent course of action. You have a natural in that hunting seasons, for example, conflict with very few other forms of recreation. And what better way is there to escape the possible negative effects of this program on fish and wildlife? How else but through active participation in your state's recreation plans can you assure the retention of areas for unique outdoor experiences, such as trout fishing, and finding wilderness species, like wild turkey, bear, moose, or mountain lion? Mass recreation experiences can and will be furnished, but I hope not at the expense of quality outdoor experiences. There *are* limitations to the multiple-use philosophy.

These are some of the things "we" must do to insure that fish and wildlife resources, and that public which is so deeply interested, get a fair share of consideration within state recreation plans fostered by the Land and Water Conservation Fund Act. Anything less may not only severely limit your participation in the future decision-making processes within your state on public recreation—it may severely limit your supporting public.

We may draw some conclusions about the potential benefits of this program from the record of the Federal Aid in Wildlife Restoration Program administered by the Bureau of Sport Fisheries and Wildlife. The Federal funds for this program are derived from an 11 percent excise tax on sporting arms and ammunition. Apportionments to the state fish and game agencies under the Wildlife Restoration Program totaled \$19.2 million in Fiscal Year 1966. The minimum matching requirement of 25 percent indicates a total program for that year of something over \$25 million for wildlife only. These funds are used for land acquisition, development, research, and other activities related to wildlife and public hunting.

Of the 2,582,085 acres purchased through the Pittman-Roberston program since 1938, about 1,031,036 acres have been for waterfowl and other migratory birds, over 1,000,000 acres for upland game, and 577,966 acres for the preservation of critical wintering ranges in the West for elk and deer. Similarly, since 1952, 60,048 acres of land have been acquired under the Dingell-Johnson program, which includes land for lake construction. A total of 167 lakes have been built or

restored, which provide 15,328 acres of new water and 1,921 acres of restored water. Combined P-R and D-J funds have created 55 lakes with 10,750 surface acres.

As of June 30, 1965, the states operated 1,600 wildlife management areas and refuges under this program. These encompassed about 49 million acres of public and private lands purchased or made accessible, of which about 99 percent was open to the public for hunting and other outdoor recreation.

While there has been a substantial increase in the funds for the Federal Aid program, increasing costs for operation and maintenance of existing areas make it imperative that other sources of federal and state financing be obtained. The Land and Water Conservation Fund can materially complement and supplement our efforts to increase the area of public land open to recreational hunting. It will at the same time increase the multitude of associated recreational opportunities which hunting areas afford.

So far, I have dwelt exclusively on the state wildlife administrators' responsibilities in promoting an aggressive use of the Land and Water Conservation Fund. Now I would like to discuss the federal programs that Act will augment.

First, the land acquisitions authorized by the Act will frequently have significance for wildlife irrespective of the agency making the proposal, and three of the large recreation-furnishing agencies will be acquiring land—the Forest Service, the National Park Service, and the Bureau of Sport Fisheries and Wildlife. In its first proposals, the Forest Service recognized the need for consolidating its land holdings in the area frequented by the very rare California condor. Most of its other proposals and, indeed, those of the National Park Service, will facilitate all aspects of their fish and wildlife management programs.

As for the Bureau of Sport Fisheries and Wildlife, we anticipate modest future expenditures from the Land and Water Conservation Fund for lands needed in the national program for the protection and preservation of rare and endangered species, and for the purchase of relatively small areas adjacent to national wildlife refuges needed to accommodate special recreation areas. Regrettably, the authority of the Secretary of the Interior to make purchases for rare or endangered species has not been recognized by the Congress, and the legislation to correct this situation is still under consideration by the Senate, having been passed by the House of Representatives in the first session of the current Congress.

Even after the enactment of suitable authorizing legislation, we do not expect a large land acquisition program for endangered species. It seems likely that most habitat needs for these animals can be

accommodated on areas already in public ownership or control; and that much of the total endangered species program will consist of research in various phases of animal physiology and behavior, and in developing management concepts which will encourage needed habitat preservation or actual individual animal protection.

Before closing, I trust that you will indulge me in some philosophizing on the big picture in natural resources management—on the reshaping and redirection that is taking shape in our own field of interest. The new thrust in conservation is toward quality—quality, and a consideration of ecology as a conceptual basis for conservation in action. But this is not limited to improving the quality of the physical environment apart from man, important as that is. There is, in fact, an urgency to maintain or improve the position of man, himself, in relation to his environment and its quality. Our affluence in things material has been achieved at a substantial cost to the human resource, whose welfare presents the greatest of conservation challenges. I think that we “professionals” may have in the past been too concerned with the enhancement of natural resources, *per se*. Must we not now recognize that there is another challenge: to conserve, deploy, and use natural resources in such a way as to maintain and enhance the human resource? These are the needs that have prompted new legislation, fitted to our times, to make more outdoor recreation opportunity, including hunting and fishing and other wildlife-based pursuits, available; to clean up and protect water sources; to abate air pollution; and generally to make this present world a better place to live in.

In summary, the Land and Water Conservation Fund Act does provide one of the most substantial opportunities for wildlife that have been provided to resource managers by federal legislation in years. We owe it to the resource and to our constituents to make the best use of it that we can.

As you have observed, no panacea is offered here for getting the most for fish and wildlife out of the Act. There is no substitute for good judgment and coordinated common sense, and a sincere desire to serve the best public interest.

## IMPACT OF THE LAND AND WATER CONSERVATION FUND

EDWARD C. CRAFTS<sup>1</sup>

*Director, Bureau of Outdoor Recreation, Washington, D. C.*

One of the panelists referred to the fact that in his administration of the Land and Water Conservation Fund in his state it was not a popularity contest. I can assure you that, from where I sit, it is not a popularity contest either.

There is and has been a good bit of reference to whether fish and wildlife interests and related agencies are sharing proportionately in the benefits of the Act. I wish, in a way, you could have been where I have been during the past few weeks, talking to different groups.

One of these was the Bicycle Institute of America. They were concerned lest sufficient attention not be given under the Act to the acquisition of lands and the development and building of trails for those interested in bicycling. This may strike you a little bit odd but, on the other hand, it is typical. Perhaps you do not know that there are more bicycles sold in the United States in one year than automobiles.

Last week I met with about 800 people in Connecticut, at the Governor's Natural Beauty Conference. Here we had enthusiastic and dedicated citizens from all walks of life, and their primary concern had to do with the acquisition, development, and beautification of lands along the valley of the Connecticut River. Their concern was whether the Land and Water Conservation Fund Act was going to help along this line.

The following day I met with the American Camping Association at Chicago. About 2000 of their 9000 members were present. Their concern was the impact of the Land and Water Conservation Fund Act on their particular interests; and these were the people who, for the most part, either operated camps or were engaged in camping in some form. They expressed the same concern and the same interest.

Maybe I might say this, especially in connection with the answer to a question that seems to be in the forefront of your minds at the present time—that, of the state projects that we have before us at the present time, most of which we have acted on, 30 percent of the money bears on fish and wildlife or game projects in one way or another, and 18 percent of the projects bear on this. I think this may surprise you a little, but I think it also surprised me when I asked that these figures be brought together. I think it does demonstrate that we have

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<sup>1</sup>Dr. Crafts spoke extemporaneously without a formally prepared paper.

been successful in our first year in at least giving a fair amount of attention to the particular interests that you people share.

What I would like to do in the few moments is to give you what might be called a brief stockholder's report on the first year's operation of the Act.

For the most part, those of you who are present here this morning are professionals. You know the Act pretty well, and so I am not going to say anything about its requirements or provisions. However, I am going to try to tell you a little of what has happened and point out to you the basic problems, or opportunities, depending upon how you want to look at it, that lie ahead of us in the next few years.

First of all, let me say that we originally estimated that revenues to the Fund would be \$125 million this fiscal year—that they would go up during the next fiscal year to \$137 million, continue at about that level for a few years, and then peak at about \$150 million.

The primary sources of income to the Fund were to be from federal surplus lands and motor fuel taxes, the annual recreation permit and miscellaneous other admission and user fees.

Now, what has happened? First of all, Congress appropriated the full amount of our projections. The Congress and the Administration accepted the principle of what they termed "full funding"—that is, appropriating up to the limit of the income to the Fund. Income from the sale of surplus property has pretty much been on target. As a matter of fact, it is running a little over. Income from the motor fuel taxes has likewise run over.

Income from the miscellaneous admission and user fees has been about what we estimated.

Income from the federal recreation permit has fallen flat on its face. Of the \$125 million, we had estimated that about \$25 million would come from this particular source. We find thus far, that instead of the \$25 million we have estimated, we have, to the present received about 10 percent or \$2.5 million. It may even run to around \$3.5 million by the end of this fiscal year. In other words, this has been an 80 to 90 percent failure. This is also why the Administration reduced the request for the Fund for the next fiscal year from the original estimate of \$135 million down to \$110 million—simply because we could not demonstrate to our own satisfaction, nor to the satisfaction of the Bureau of the Budget, that we could see revenues from permits up to our original expectation.

We are still, however, projecting an estimate next year of about \$13 million, which is about five times what we had this year.

We think, despite the failure of the permit income, that because of the carry-over of funds from last year before the program really

became operational and also from the small excesses that we have had from our surplus property, that we will have about 80 to 90 percent of the \$125 million available this year. If we fail to make that figure, this means that the federal agencies who participate in the Fund, and the states, will have their apportionments reduced on a pro rata basis.

We are at the present time funding up to about two-thirds to three-fourths of the full federal allocations and the individual state allocations. I think that, before the end of the year, we will be able to go above that.

I might also say that of the more than \$2 million that we have taken in, the source is almost exclusively from the Park Service and the Forest Service. The same is true of the other miscellaneous user fees.

I also want to say, here and now, that while the Park Service did a good job and sold more permits and took in more money than the Forest Service did, the Forest Service nevertheless, in my opinion, did an outstanding job in getting the program under way last year.

In the allocation of funds between the state and federal agencies, the states, last year, as a result of the action of the Appropriations Committee, received about 70 percent of the money. They would have been eligible, had we run up to expectations, for \$94 million; the Park Service for \$26 million; and the Forest Service for \$18 million. The Fish and Wildlife Service, was left out of last year's appropriations by the Appropriations Committee.

We have actually funded about \$87 million this year—\$58 million to the states, a little over \$17 million to the Park Service and a little over \$12 million to the Forest Service. This was as of the end of January, 1966.

Obligations have been underrunning this because it has taken both the state and federal agencies some time to get geared to a new program of this size.

During this fiscal year, the Park Service proposes to acquire about 73,000 acres of land, the Forest Service 150,000 acres. The average cost of the federal acquisition is a little under \$200 per acre.

It is interesting to note that the average cost of the acquisition projects that are coming in from the state and local governments is running just about the same, about \$200 per acre. Therefore, it would seem that the federal and state agencies are operating on about the same level.

Next year the proposal is that the Park Service would have \$28 million out of the \$110 million; the Forest Service would have \$13 million and the Fish and Wildlife Service would have about \$1.5 million. This was a major change between the Forest Service and the



Park Service, especially at the last minute, in order to include \$10 million for a proposed Redwood National Park. This resulted in reducing Forest Service allocations by \$5 million and also adjusting the Park Service allocation by \$5 million.

The states can be proud of their accomplishments, especially since this program is still less than a year old.

There has been quite a bit of talk about planning this morning. You can plan and keep on planning. You can plan for the sake of planning. However, the Land and Water Conservation Fund Program is not that kind of program. It involves planning only as a pre-requisite to an action program.

We have to make a fundamental policy choice at the beginning as to whether we are going to recommend to the Secretary that the state plans meet all of the requirements that we think are necessary to a truly comprehensive plan or, on the other hand, whether we are going to ease into this over several years with periodic revisions. Rightly or wrongly, we took the latter course.

Of the 55 state and territorial plans that will be involved, 45 states have approved plans at the present time. There are five in the Bureau under review and there are five that have not yet been received. I think that is a remarkably good record in a year for that large number out of the total.

Approval is what we term "interim" approval and revisions in state plans will be required at various intervals in the years ahead.

Now, with respect to the action projects—both the planning grant projects and the acquisition and development projects. I think you may be interested in this. Thirty-nine states have applied for planning projects, and we have granted about \$2 million in money for planning assistance.

Twenty-nine states have 185 acquisition projects either approved or pending in the Bureau, these totalling some \$24 million.

Thirty-five states have some 270 development projects in the same category, totalling some \$38 million.

This means that 47 states are actual participants at the present time with 500 projects and some \$64 million of federal aid involved. This is about where we stand.

With respect to this federal permit, we are prohibited, under our statute, from spending Land and Water Fund money for publicity, but we can spend it for informational purposes. There is a fine distinction involved here.

This year we are being helped financially to overcome this problem of public education by grants from the Rockefeller Brothers Fund and from the Old Dominion Foundation. I want to say publicly here

that we deeply appreciate this, and I think it will make a very significant difference.

Also, the sale of the seven-dollar "golden passport," as it is called, starts on the 25th of March. It will be sold at some 6000 to 7000 federal recreational sites throughout the country and at many other outlets. We have also entered into a contract this year with the American Automobile Association to sell it at all of their outlets. We have even been in touch with the airline companies, the travel bureaus, the oil companies, even the comic strips, and we now have about 40 or 50 educational outlets which will begin to function very shortly.

Of course, the sales of the bulk of these permits come during the vacation months of June, July, and August, and so this is when the educational drive will pick up. We have asked all of the major conservation and recreation associations to enter into a cooperative agreement this year to merchandise this permit through their own membership and their own magazine outlets. We can do this very simply.

While this is government-accountable property, we can make it available to any organization and in whatever quantity of permits they desire. They do not have to pay for them in advance. There is no bonding required and, at the end of the year, they either have to return to us the money for the permits not returned or the unsold permits. Therefore, it is very simple. Further, there is no commission involved.

Unfortunately, we have had very poor response from the conservation and recreational organizations relative to this appeal. A few have indicated that they would participate, that they would publicize it, that they would run order blanks in their magazines and also take a number on consignment. However, most of them have indicated they did not desire to participate.

We have made similar requests to all of the states this year. The states perhaps are in a little more difficult situation because there is a tendency, when utilizing state outlets, to have the federal permits confused with those that the states sell for their own fee systems, such as fishing and hunting licenses. However, some of them have responded, and the arrangements are the same.

This year the Bureau of Sports Fisheries and Wildlife is joining in the program and, as a result, a significant number of its wildlife refuges will be charge areas. This will also be true of its fish hatcheries. The Bureau of Land Management now joining in to a much greater degree in this program than was the case last year.

Our big question with regard to the program at this time has to do with the success or failure of this annual Federal permit. I don't know how to make it any clearer to you. Last year, as you may know, was a year of trial and error.

I am sure that, if we are optimistic about this and work at it, we will make it. On the other hand, if we do not make it, then there will have to be some reassessment of the whole program.

The other side of the coin is escalation in land values. This has a major bearing on federal acquisitions and particularly those of the National Park Service. The Forest Service has the same problem, but they do not have ceilings in authorizations as the Park Service for the most part does.

There are about 50 authorized acquisition areas for the Park Service at the present time which have statutory dollar ceilings. Twenty of those involve the total need exceeding the ceiling limitation put on by the Congress. Those ceiling limitations add up to \$68 million. We know that if we were to go out and purchase that land tomorrow that it would cost more than twice that \$68 million.

At any rate, this is the problem we face on the other side. Of course, there are ways to get at it. You can increase the advance appropriation of the Fund, and we propose to do this. This means, in effect, that we shall be able to compete with the land speculator on a treadmill in order to see whether he or the government gets their first with its money.

You can also increase the revenues to the Fund either through permits or other sources. Here I refer to the earmarked revenues that the Interior Department receives. Those range from \$50 million to \$200 million a year at the present time.

There is another method that we might consider, and I merely throw it out for your consideration. This would involve a punitive, confiscatory capital gains tax on the speculative increase in the value of the lands from the time that the Government, whether it be State or Federal, interests itself to the time that it actually purchases the land, with the further requirement that proceeds from this tax go into the Land and Water Fund. I would believe that a tax of this kind would also remove much intensive speculation in connection with land purchase. On the other hand, it would not be penalizing the fund, because it would not make much difference whether you bought the land the year after it was authorized or even ten years after authorization. In other words, if you had to pay ten times as much, you would get it back through taxation and it would go right back into the fund. We are exploring this with the Treasury Department at the present time. This is one of the avenues that is being explored

partly as the result of the reference to this problem in the President's recent message on preservation of our natural heritage.

I want to express my appreciation publicly to the federal agencies and the state agencies and also to local governments for their participation in the program this year.

I also endorse what John Gottschalk said here today—that there is a real problem with respect to federal acquisition for the preservation of sports fisheries and wildlife, particularly in relation to endangered species. It is hard to persuade Congress that you need to spend some dollars to preserve a small number of birds or animals or whatever it might be. However, with your help and support, I am sure that the program will continue to a successful conclusion.

## TECHNICAL SESSION

Wednesday Morning—March 16

*Chairman:* DAN SAULTS  
Information Officer, Bureau of Land Management,  
Washington, D. C.

*Discussion Leader:* BRYANT R. CHAPLIN  
Chief, Information and Education, Massachusetts Division of  
Fisheries and Game, Westboro

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### CONSERVATION INFORMATION AND EDUCATION

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#### LET'S RE-EVALUATE PUBLICITY PROGRAMS

DON CULLIMORE

*Executive Director, Outdoor Writers Association of America, Columbia, Missouri*

The title of this, "Let's re-evaluate publicity programs," is a formalized version of my whimsical suggestion that it be called "Count Your Releases, but not like sheep. . . ."

In seeking an inspiration for developing this topic, I retired to the solitude of what I refer to as my study—my wife calls it "the paper jungle"—and began ferreting through the formidable accumulation of mail that finds its way to an outdoor writer's desk.

We get a *strange* admixture . . . you'd be amazed . . . a twist of chewing tobacco grown in the Tennessee holler where they distill a concoction known as Jack Daniels Black Label . . . a new fishing lure which its manufacturer absolutely guarantees will catch fish . . . (they never work, for me) . . . a sample bottle of hair restorer with a similar guarantee (it didn't work, either . . .!) . . . provocative pictures of pretty girls with shapely unclad legs—you know the kind, so posed you can't *possibly* run a picture of the girl . . . without showing the brand name of somebody's outboard motor. . . !

These can be disposed of quite simply. Much of the material cannot. It comes in a daily deluge from a multiplicity of sources—

governmental agencies on all levels; industries and industrial trade groups; private organizations and unaffiliated individuals.

It deals with conservation, or in subjects that affect conservation or are affected by conservation. And, it compels reading, at least to the extent where a reasonable assessment may be made of its intent, accuracy, and informational value.

We wade through the stuff. That is, we wade through most of it. Some, which comes from sources notorious for confusing gobbledygook, irrelevant subject matter, inept writing or overcommercialized product releases, goes directly into File 13, unopened.

Having chucked these, we winnow through the rest of it. There is the obviously self-serving and distorted propaganda—and the propaganda that is not so obvious. There are emotionally biased editorial outbursts; so-called policy pronouncements which skillfully sidestep the issue; and the calls to arms “For God, flag, motherhood and preservation,” which contain a maximum of maudlin sentiment and a minimum of quotable sense.

Let me point out that these comments are not necessarily pointed at—or restricted to—all the governmental agencies and private organizations which are engaged in promoting conservation. The material which we, as outdoor writers, receive comes from many sources. Some have a correlative, or by-product interest in conservation. To some, conservation, in *our* concept, is of interest only because they view it as a threat to their economic aspirations. When you step on somebody’s pocketbook, you get a reaction—sometimes a quite persuasive one.

When I say “we” go through this material, I’m speaking of the interpretive writer, or editor, who makes the final decision on how much of it is going to reach his reading public—and in what form. All of the press releases and other information issued aren’t worth a hoot unless they produce results in terms of publication.

In my experience this latter—ultimate publication—is an item too often overlooked, or possibly forgotten. The writer of press releases too often is prone to write what he would *like* to see in print—or what his superior would *like* to see in print—rather than presenting what the intermediate outdoor writer or editor is *most likely* to print.

In any evaluation or reevaluation of publicity, I would recommend that the author thereof place himself mentally in the editor’s chair and look at his manuscript critically with the thought, “If I were to receive this, would I find it usable?”

I mention that only in passing. My intention here is not to conduct a critique of techniques of release preparation but to categorize a very rapidly changing scene as it relates to your approach in providing

information to the public. My purpose is *not* to provide the answers, but to provoke thought on what you—or your organization—has done, or is doing, to meet this changing scene.

Later on this panel discussion, Clint Davis of the Forest Service will discuss Conservation's "third wave." It was quite interesting, when we compared notes late yesterday—after both of our addresses had been prepared—to discover that the inception of Cilff's "third wave" was identical timewise to that of my "changing scene."

Let's go back a few years ago; five, to be exact. Then, conservation agencies and outdoor writers were trying to put across a very simple and basic ideology—that conservation was important and that time was running out. We still faced a degree of sportsman skepticism; we faced industrial apathy if their own economic interests were not concerned, and industrial opposition if they were. Most disheartening of all, we were up against a wall of general public indifference to the whole subject. It was just too abstract. There were exceptions to all these, of course; I'm dealing in generalities.

All of a sudden there has been a lot of change. Conservation has graduated from unwanted orphan to fair-haired hero status in the nation's press (and in general news recognition). It's a popular public-interest news topic, instead of being largely dismissed as the emotional outburst of starry-eyed do-gooders.

In that five-year period, there has been an amazing change in public receptivity toward information which relates—in one way or another—to conservation. It has an evolutionary background, of course, but the shift from snails' pace to jack-rabbit speed has come since 1960. For a variety of reasons, which we're all familiar with, more people have been stimulated into doing more things in the outdoors. As a result, they've become more observant as to what's happening to the outdoors; and in a proprietary sense they look upon it as *their* outdoors.

For the first time in the history of this country, the mass public looks upon the outdoors as theirs in terms of something to be preserved instead of something to be exploited. Realization has come that it means fish-laden clean waters, wildlife-populated forests and prairie lands; it means the thrill of observation, exploration, adventure and activity—whether that be expressed in fishing, hunting, camping and boating; or on the appreciation level of scenic vistas unobscured by billboards, the unique and irreplaceable beauty of some undammed wild river, or the sight and songs of birds.

So . . . that wall of public indifference to conservation has been breached, suddenly and broadly. When it existed, you assaulted it with a campaign aimed at selling the basic ideology of conservation—

today, the public's out ahead of you. Conservation is no longer abstract. It has been sold on the elementals of the ideology. Legislation which for years had languished for lack of support has been passed handily. Ideas which a few years ago appeared only as remote and virtually unobtainable dreams now are coming of fruition, or are on the verge of doing so. The "Wild Rivers" concept is an outstanding example.

Today it's not the basic ideology of conservation that's at issue—it's the implementation of that ideology. The patterns of the old campaign, and the weapons for breaching the wall, are not necessarily the most effective for consolidating the gains.

Even the old, and often rancorous conflicts with industry are beginning to go down the drain. We are all too familiar with the scars, and the waste, and the pollution and despoliation of the past. This should in no way deter us from recognizing changing attitudes in a more enlightened and conservation-conscious generation.

Let me quote from a published address, to his industry, by President Harry S. Mosebrook of the Southern Pulpwood Conservation Association:

"A major public relation problem is the need to reach conservationists with our message. Conservationists now swing the balance of power. They are influential in government and particularly in developing policy of government. . . .

"Conservation itself has a new concept embracing the policy of the preservation of 'natural beauty.' At the White House Conference on Natural Beauty, conservationists as a group were the predominant factor, as they are in demanding the elimination of pollution. We must learn to reach this group of important citizens by talking their language . . . and we will find that when we do this, we have much more in common than we have in disagreement."

This is representative of a national trend, and acceptance. . . .

Now is the golden opportunity to orient I & E—and departmental—thinking and planning to capitalize on these transitions. Instead of bucking public skepticism and disinterest, there's an increasingly receptive and better informed audience. Industry is increasingly cooperative; sometimes as a self-serving necessity, perhaps, but the important thing is the end result. And so far as the intermediate liaison in communication is concerned—the outdoor writer who may discard, use or embellish a press release—the I & E man is dealing with an entirely different breed of cat than was the case a decade ago. Today's writer is more objective and less emotional, more interpretive, and with an audience whose interests transcend routine reports on fishing and hunting conditions.



This is the time for each conservation agency or organization to re-evaluate its promotional approach and program. Does it meet the opportunities of the transitional scene? Is it adhering to a 1956 P/R philosophy which hits only the edges of the available 1966 target? Are we tabulating our conservation P/R efforts on the basis of the quantity of material produced in the same old pattern—or on the basis of quality, in terms of depth, perceptiveness and effectiveness in influencing today's conservation-conscious public?

Do we realize this situation: That, instead of being a Don Quixote jousting futilely at an insignificant windmill, conservation today—in much of the public mind—has become the knight in shining armor slaying the deadly dragon!

#### DISCUSSION

DISCUSSION LEADER BRYANT (RED) CHAPLIN: Don, you presented the outdoor writer as having advanced to a state when he is no longer interested in pictures of girls. I find this hard to believe. Is there anybody in this group who disagrees with Mr. Cullimore's thesis?

Don, you mentioned in passing that the writer of the press release must place himself in the editor's chair. How in the dickens does he do this when the boss wants something out that the press release writer doesn't think is worthwhile?

MR. CULLIMORE: Red, that is your worry.

DISCUSSION LEADER CHAPLAIN: Do we have any questions in the group for Mr. Cullimore?

How many people here would care to comment about a change in their philosophy from the PR philosophy that Don mentioned of ten years ago? I am curious to see if anyone has changed their approach to the problem of getting copy into newspapers.

MR. JAMES ROBEY (Dayton *Journal Herald*, Dayton, Ohio): I am an outdoor writer myself. I would like to say I was formerly an information writer also, and with what Don Cullimore says, who has seen both sides of it, I can say he really hit the nail on the head and if it appears that we are not interested in pretty girls anymore, it is not exactly that. It is just when they have got the product stuck in front of them that makes it so objectionable.

MR. SETH L. MYERS (Sharon *Herald*, Sharon, Pennsylvania): I think Don should have said that we—I am a member of the Outdoor Writers—that in the past ten years we have had a leading position in educating a lot of editors of papers to approach resources problems through the outdoor writers' columns. I for one take a lot of credit in my paper for educating the paper to commit us to change and to make this change for better education of the general public.

I have told my editor that I think he needed a dose of education, and if he didn't mind, I was going to give him some. He called me in one time and he said, "Through your column seven men lost their jobs at a sand and gravel operation." I said, "Well, Derry, is it better for those seven men to lose their jobs or for 75,000 people in the valley to lose their good water supply?" He said, "Okay, you go ahead and write it, and you under your name, will stand responsible for any of those jobs."

I think that is very important in getting the story across to the modern public and the industrialists that Don mentioned. These people, of course, have all kinds of degrees in everything except conservation matters. I am of the opinion that we have done a good job, but there is a lot yet to be done.

DISCUSSION LEADER CHAPLIN: Don, you mentioned placing yourself in the editor's chair, and I think this a key thing. I think every person responsible for writing press releases has got to do this. You recognize that the outdoor writer has

problems. He has space problems, and he has editorial problems. And he has a boss. Would you comment on what I and E people and others in the departments might do to help the outdoor writer with his problems?

MR. CULLIMORE: Red, I am shooting a little bit in the dark here. The core relationship is between the editor's chair and the outdoor writer.

DISCUSSION LEADER CHAPLIN: What I am thinking of is the complaint we often hear. We have writers tell us: We had one heck of a good story, but my editor cut it. Or: We don't have space for this. We see baseball, for example, getting more space than outdoor writing. Is there anything that we who are furnishing you with releases can do to place you in a higher status on the paper?

MR. CULLIMORE: Unfortunately, Red, I have been divorced from a paper for so many years that I am not currently facing that problem. As we all know, the attitude of newspapers varies a great deal in regard to the outdoors. Particularly when you happen to get into the sports staff, the outdoors is likely to go out the window for bowling news or something else. I think the need is for a campaign to persuade the editors of the papers to take the outdoors off the sports page or to set aside a stipulated amount of space for it.

This has been done on the *Kansas City Star* especially with Ray Heady, and quite a few others, but outside of a campaign for this, I don't know what to do.

CHAIRMAN SAULTS: When the suggestion for a paper came in from the next speaker, the Program Committee and I, myself, were a little startled. The Program Committee and I are roughly of an age when we attempted to sell our programs by crying doom. And we received a suggestion, at least, from Roland C. Clement of the National Audubon Society, a staff biologist, who suggested that maybe we hadn't been on the right track. We felt that he ought to come here and tell you his views.

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## DANGERS OF PESSIMISM IN CONSERVATION

ROLAND C. CLEMENT

*National Audubon Society, New York City, New York*

Man is a creature doomed to the dangerous art of forecasting. Every matter-of-fact statement, like the foregoing, takes so many presuppositions for granted that it is always a wonder that we can converse at all.

This possibility of agreement comes from the fact that, at any given time and place, we share a multitude of assumptions about what we call reality. These form the "climate of opinion" we swim in.

It is only when something disturbs us and we enter into controversy over it that we become aware of how precarious a consensus is.

If we analyze our problem, we soon realize that every assumption is a projection, a forecast. It is a forecast because it has to do with the future. We do not make assumptions about the past, only errors of interpretation. That most of our prophecies are mistaken is beside the point. Even those who "refuse" to forecast are assuming that the *status quo* will prevail, and this is one of the most childish of all prophecies.

Scientists think they have learned how to guard against the errors of prophecy by differentiating between a projection and a prediction.

The projection is said not to commit or to determine the future, but only to suggest that "if past experience continues" such and such a result may be looked for. Projections, then, are useful in suggesting the potentialities of a situation. But since they are abstractions, they have little currency outside academic circles, since life is not lived in the abstract. The need for day-to-day commitment causes us to turn every projection into a prediction, or to reject it and seek another.

These truisms may provide perspective on another form of scientific rationalization. It is one which has been much resorted to recently by those who do not like to face the implications of the conservationist's insistence that many of our current pesticides practices threaten a number of animal species. Innocent or not, these apologists take what appears to be learned recourse to the evidence of geology or to the pessimism of older naturalists, now often deceased, to show that species are always on the road to extinction.

We need, therefore, to study the rate of extinction, and in doing so, to beware of the dangers of forecasting.

The evidence was summed up recently by James Fisher (in Thomson, 1964). Analyzing the known fossil record, he concluded that bird species had a life expectancy of 1.5 million years prior to the Ice Age. The cataclysm of the Pleistocene dropped this expectancy to 40,000 years; but since the advent of man's domination—in the last 300 years or so—the life expectancy of bird species has dropped to 16,000 years. Man's heedlessness is considered the cause of more than half of this accelerated decline.

In a study of peregrine populations two decades ago, J. J. Hickey (1942) set the modern rate of decline in this species at 11 percent for the period 1840-1940. We have, then, two curves of decline. One is that of geological time, a very slow one when measured by all the earth's species; and a steeper one indicative of man's disruptions during the last few hundred years or so, which must be superimposed on the geological curve.

My object in reviewing these facts is to suggest that there is now a third and much steeper decline curve which should be superimposed on the first two. It is a result of the environmental contamination which is now affecting a number of end-of-the-food-chain species, especially birds.

The collapse of the breeding population of the eastern peregrine since Hickey studied it is the most dramatic event in this new sequence. But the bald eagle, the osprey, the Cooper's hawk, and some of the herons all seem to be suffering from the same or similar attrition factors. Similarly abrupt declines are occurring wherever modern synthetic chemical pesticides have been used enthusiastically

since World War II. The British ascribe their peregrine decline to dieldrin poisoning, the Swedes to mercury, the Israeli to thallium, all materials used as seed dressing in agriculture. In this country there is abundant evidence to incriminate DDT, perhaps in combination with other pesticides, or even with other as yet little studied contaminants.

If, a decade ago, we had proposed marketing a product designed to depress the reproductive success of these end-of-the-food chain species, there is little doubt that we could have obtained a registration certificate for these pesticides. But because these chemicals came into use before we were aware of their full biological implications, the evidence of the damage they are doing will not be acted upon until every positivistic hurdle we can conceive of has been surmounted. In biology, where everything affects everything else, this is a long, slow task.

It is now important to recall that such topflight ornithologists as Alexander Wetmore and Edward Howe Forbush "gave up" the shorebirds as doomed fifty years ago, yet not one has become extinct. Forbush (1912) wrote of the Eskimo curlew (p. 417), "a few small flocks or single specimens may yet be seen or taken; but it is too late to save the species. Its doom is sealed." Forbush wrote in the same vein about the whooping crane (p. 483); and of the trumpeter swan (p. 476) he said, "the trumpeting . . . will soon be heard no more. In the ages to come, like the call of the Whooping Crane, they will be locked in the silence of the past." In the 1960's, however, a half-century after Forbush made these pessimistic forecasts, Eskimo curlews were again being seen in Texas and a specimen was taken in Barbados; and the U. S. Fish and Wildlife Service was live-trapping trumpeter swans at Red Rock Lake and scattering these surplus birds around the continent to start new flocks.

No species has suffered more from man's pessimistic determinations of the future than the California condor. This bird is hard-pressed by man: guns and poisons chip away at the small annual production of young; the human population explosion and its demands for space and recreation are "competitive exclusion" pressures that sorely threaten its survival. These are "facts," and those who pride themselves on being hard-headed about their facts can make logical use of them in forecasting doom for these impressive birds.

But, as Joseph Grinnell pointed out in a letter to another ornithologist as long ago as 1937, "of course the condor is doomed to extinction if man's attitudes toward it do not change and if nothing is done." Pessimism leads to apathy and defeatism, and it is these human attitudes, much more than natural factors, that are responsible for giving the future a narrow scope. As Grinnell wrote, "The major

obstacle to all attempts to aid the condor has been the disinterest of persons capable of effective action."

What Grinnell had to say about the condor, of course, applies to everything in nature. We all tend to determine the future by projecting our partial understanding. But the future is always open, indeterminate, and thus subject to influence. We can "save" or doom a species both by what we do and by what we think and say.

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#### DISCUSSION

MR. WILLIAM S. HUEY (New Mexico): Roland, I think the attitude of information and education people and public relations people should be one of optimism but present the pessimism. You present the doom but take the optimistic side of it by giving ideas and techniques or perhaps even just suppositions of how this doom may be averted.

Oftentimes people respond more to this forecast of doom than they do to a minor angle of escape from doom. If we take a real hard optimistic attitude toward methods to avert doom, I think perhaps that might be the way to take care of a lot of these problems.

MR. CLEMENT: Bill, you and I are both right and both wrong, and this is the dilemma of all communication. Now I recognize two kinds of pessimism. There is emotional pessimism which says: It's no use; let's forget it and do something else. And this is the one that I want to oppose. And then there is intellectual pessimism which simply says: Things look dark as the dickens, and I don't see a way out. Now this we must face up to, and we must put the facts on the line, but then let's not say the situation is impossible. Let's recognize that our understanding is always partial, that we must keep the future open, and that we must push in the right direction. This is my objective.

DISCUSSION LEADER CHAPLIN: Any other comment? I couldn't help but be taken by Dr. Clement's reference to shore birds because, in my estimation, it was the intellectual pessimism of the sportsmen who put through regulations eliminating the shooting of shore birds which resulted in shore birds still being around today.

MR. JEFF INGRAM (New Mexico): I have to answer this point because even intellectual pessimism can be disturbing if it's intellectual pessimism by a man of science, by an accepted expert, because too often academic people will say: This is the way it looks. They will make a projection. They will not say: This is how it can be averted. They will say: These are the facts, but they will not come up and say what possible policies could be effective to change the facts. Even when they do, if they should make a suggestion as to what can be done, they very often will not then use the weight of their academic expertise to support policies that they think might avert the dark end.

MR. CLEMENT: That is a good point, and let me suggest that the most dangerous positivistic notion of our day is the notion that the population is going to continue growing at the same rate that it has grown in the last 50 years.

And if you listen carefully at these meetings, you will find that a great deal of what they are projecting to do, whether in public health or animal control or something else, is based on this extrapolation of the present population curve, and this is dangerous.

DISCUSSION LEADER CHAPLIN: Could that possibly be because man refuses to apply the same biological principles to himself that he applies to wildlife?

## GRASS ROOTS PUBLIC RELATIONS

DOYLE KLINE

*Bureau of Land Management, Santa Fe, New Mexico*

There are five commandments which should guide communicators at the grass roots.

They are:

1. Know your sources, and go to them systematically for facts, *and* for public opinion.
2. Listen systematically to facts and opinion, and evaluate.
3. Comprehend the function of conflict.
4. Sort the possible now, from the possible later.
5. Utter that which can be comprehended.

Well known as those commandments should be, they are frequently disregarded.

This is particularly unfortunate for publicly-owned natural resources in a period of increasing population pressure and political change.

Why single out publicly-owned natural resources? Because they involve government. Government, particularly the Federal Government, is the heart of natural resources discussions today for two main reasons:

First, the Federal Government controls most public natural resources. Second, natural resource problems—with the possible exception of wildlife—now involve interrelationships that only the Federal Government can deal with on a comprehensive basis. What the Federal Government does with all other natural resources, so does the nation, for all practical purposes.

Under our form of government, ultimate decisions on all major public matters are made by the grass roots, acting through the Congress and the Executive Branch, under the watchful eye of Justice. Perceptive persons know the grass roots are in command *in the long run*.

Our commandments assume that contact with the grass roots is contact with the only source of enduring power in this country, and with the source of funds, policy, and programs.

In that light, then, let's examine the commandments we have enumerated.

We say, "Know, then go, to the Source." We speak here not so much of knowing *where* the grass roots are, although that is essential, as of knowing *who* they are. Population change makes the distinction necessary.

The change is a shift from rural to urban dominance in national affairs and in our political structure. This shift is evident in recent

reapportionment of state legislatures, and in recent creation of a Department of Housing and Urban Development.

The shift means there will be greater force behind demands for expression of urban values in management of natural resources. So-called "older" rural values will give way to "newer" urban values. As Dan Saults has observed, conservation of wildlife, in urbanity's eyes, may come to mean the production of "immediately shootable game."<sup>1</sup>

Natural resources communicators who measure the future with yesterday's yardsticks will encounter surprises soon at the grass roots.

Under our commandment, we must gather facts *and* opinion. We assume a definition of "facts" is not necessary here. But we do need to explain our concern with opinion.

To do so, recall that there is a current campaign to "save" some of California's redwood trees. There are those who want to save them to see them and those who want to save them to saw them. We are getting "facts" from both sides, carefully arranged to influence our opinion. In this example there is recognition that grass roots decisions are determined largely by opinion, and not by full presentation of facts.

The redwoods partisans know that it is impossible to place *all* the facts before *all* the grass roots. They know it is impossible for *all* the grass roots to understand *all* such facts. Further, they suspect exposure of *all* facts might result in a decision other than the one they visualize as desirable.<sup>2</sup>

The important thing for us to bear in mind here in natural resources decisions, is that we are dealing with grass roots opinion formed by our procedures and our presentation of selected facts.

Therefore it is exceedingly important that we adopt the procedure of seeking out and comprehending the opinions of the grass roots on natural resource matters.

More wrong decisions are made on mistaken hunches of what the public thinks than on willful disregard of public opinion.

Systematic sampling and evaluation of grass roots opinion will require re-examination of the role of some of our conservation information and education programs.

<sup>1</sup>Dan Saults, "What is Wildlife?" *Wildlife News Bulletin*, *Wildlife Society*, Washington, D. C., February 1966.

<sup>2</sup>Walter Lippmann, in "*Public Opinion*," says, ". . . the practice of appealing to the public on all sorts of intricate matters means almost always a desire to escape criticism from those who know by enlisting a large majority which has no chance to know." and "The private citizen, beset by partisan appeals for the loan of his Public Opinion, will soon see, perhaps, that these appeals are not a compliment to his intelligence, but an imposition on his good nature and an insult to his sense of evidence. As his civic education takes account of the complexity of his environment, he will concern himself about the equity and the sanity of procedure . . . ." p. 401.

The founders of our country believed that the citizenry, if properly informed, would be capable of making all necessary decisions on government matters.

The American value system contains a stereotype that says every citizen has both the desire and capacity to overcome his weaknesses. Further, the stereotype says, each American is inherently ambitious and a tireless seeker of higher position socially and economically. Thus, perhaps, it is logical that some communicators assume they can institute reform merely by pointing out somebody's shortcomings. Many communication ills stem from that notion!

Even so, some conservation communicators adhere to the idea, and are quite righteous in their belief that they are on the correct path. These individuals are engaged essentially in publicity work. They transmit, but they receive only by accident.

Public relations, in its fullest sense, makes use of publicity and all communications arts. But it does so only after research has identified groups of listeners, and issues and goals, and after research has guided the drafting of appropriate messages, and after selection of appropriate means of transmission.

Time-honored publicity and information-education concepts follow the stereotype. Over a long span of time, the stereotype undoubtedly has effect. The advantage of public relations is that it is capable of spotting problems and meeting them with relatively prompt and judicious action! Research at the grass roots under the public relations concept reveals needs to respond that are not sensed at all under the stereotype.

The time must come, and let us hope it comes swiftly, when all communicators in natural resources adopt a public-relations outlook and meet the grass roots face-to-face.

Our second commandment is "Listen Systematically and Knowingly."

Thoreau said, "It takes two to speak the truth; one to speak and another to hear."

Communicators want to communicate, whether or not they agree upon opinion research.

In marketing and manufacturing, in advertising and product promotion, and in public relations, systematic and scientific efforts are made before manufacture to gauge grass roots reaction to proposed products or proposed action. The findings influence decisions that follow. Fortunes are saved as a consequence, and countless blunders avoided—although not all of them!



Opinion sampling, in a different sense, is a common practice of the legislative branch of government, and political parties depend heavily upon public opinion analysis.<sup>3</sup>

But in most government programs, the emphasis is on disseminating information. Much less heed is paid to opinion analysis. Professor Donald Krimel, in a study at the University of Wisconsin, observed "the agencies of the Federal Government which carry on broad programs are almost entirely lacking in systematic, modern means for opinion measurement."<sup>4</sup>

Federal agencies do not operate with aboveboard public relations "eyes and ears" because of legislative restrictions, general public suspicion of "Government propaganda," and allegations by a jealous press of interference with the "public's right to know."

In conservation-preservation groups composed of private citizens, systematic opinion gathering rarely extends beyond the memberships. Although they profess to speak for the grass roots, such groups usually assume that the group viewpoint is the grass roots viewpoint.

It is not practicable at this point for the Federal Executive Branch to attempt to set up the systematic listening systems so important to effective grass roots communication. But it may not be necessary. In the natural resources field, other avenues may be open.

I speak only for myself, but I wonder if the "self-interest" of conservation/preservation group, or of natural resource users, might not prompt them someday to finance scientific public opinion gathering by recognized independent firms on subjects vital to natural resource programs and useful to their administrators.

Third on our list of commandments is "Comprehend the Function of Conflict."

The goal of some "information/education" programs is the absence of conflict. "Put us in a favorable light," they say, "and who will stand against us?" This is another stereotype.

Such operators tend to look upon public relations as a black, but necessary, art. The typical such executive uses his public relations counsellor would a fire brigade—only when his house is on fire.

Most such administrators fear public opinion. They have no really clear conception of the grass roots, and the forces at work there.

"Two-way communication is slim in some school systems because superintendents are afraid of it. They see it as organized back talk

<sup>3</sup>Woodrow Wilson, at a White House press conference on March 15, 1913, asked reporters: "Please do not tell the country what Washington is thinking, for that does not make any difference. Tell Washington what the country is thinking."

<sup>4</sup>Donald Krimel, from his Ph.D. thesis, "The Public Communications Function of the Federal Government," University of Wisconsin Library, 1955, quoted in *Effective Public Relations*, p. 389.

and a potential threat rather than an essential tool of modern management."<sup>5</sup>

One of the most of important services a communicator can perform for such executives, and for others as well, is that of interpreter of the grass roots.

Avoidance of conflict at any cost is not possible for long for a government dealing with natural resources, especially when they are involved, as ours are, with complex sociological, economic and environmental ramifications. *We cannot move away from problems, and toward solutions, at the same time.*

If our goal is solution of problems, we will recognize conflict as a part of the process of establishing equities, and we will choose the wiser alternatives, and settle our differences.

If, on the other hand, our goal is contention and stalemate, or the exclusion of other interests, the conflicts—which are inevitable—will not lead to problem solving and justice, but to greater problems and greater conflict.

In these contests, as of old, self-interests will attack each other. The problem should not be the negation of self-interest, but its management.

James Madison conceived the separation of powers within our government as the means by which to balance and to control self-interests. Thus, he argued, equities eventually emerge and justice eventually is done. This is not an "instant conservation" concept. Neither will it lead to instant multiple use.

We should cherish recognition of equities as the shortest path to meaningful multiple natural resources management, and conflict as the best available means to establish equities. Only then can we really face up to the urgencies of conservation and preservation, and balance them with the urgencies of equity and justice.

In dealing with our natural resources conflicts, we deal also with evolution as a society. Reinhold Niebuhr says ". . . the morality of collective man in its highest reaches is governed by a wise apprehension of concurrent interests, rather than by a sacrifice of the 'lower' to the 'higher' interests."

He argues that a realistic concept of human nature recognizes self-interest as inherent in man's drive for justice, and "the tribal limits of his sense of obligation to other men" as the chief source of man's inhumanity to man.<sup>6</sup>

Thus, lest partisan conservation communicators fall into the pit of their own self-interests, they must strive for a wise apprehension of

<sup>5</sup>From *Trends in School Relations*, quoted in *Effective Public Relations*, p. 119.

<sup>6</sup>Reinhold Niebuhr, *Man's Nature and His Communities*, pp. 80 and 84.

concurrent interests, and possibly for a transfer of interests. And they must extend the tribal limits of their sense of obligation to others in order to arrive at enlightened multiple use of resources, and a consensus as to conservation, preservation and restoration.

The conservationist communicator who cannot be fair to other interests in this conflict and the government administrator who has no stomach for the conflicts attached to his responsibility serve neither the cause of natural resources nor the nation.

Let's turn now to our next commandment, "Sort the possible now from the possible later."

Time does not have the same value in each and every circumstance, or for each and every person, or thing.

Developing an awareness of the relative nature of time as it pertains to natural resources, and the issues that surround them, is the fourth commandment for the communicator.

Walter Lippman, in *Public Opinion*, says proper calculations of time should enter deliberations on every social problem. For example, he says, different theories of time will pertain to the formulation of a sound forest policy and, over geological time, to the production of coal.

"More and more we are grappling with the problems of choosing between a dam and a park, or between a dam and no dam—between a wild river and a developed river."<sup>7</sup>

It is during debate on these issues that our sense of relative time eludes us, especially in emotional references to the future and to "principle."

An acute sense of relative time would show that bargaining for "principle" often reduces discussion to a go-or-no-go proposition. When such all-or-nothing attitudes get tangled up with natural resources objectives otherwise attainable, they sacrifice accomplishment for argument.

Natural resources problems, with all their modern overtones, have a way of forcing decisions which nobody really likes. But conservation battles in which the goal is stalemate, rather than decision, bring about natural resources management by delay. The decisions come eventually, just as Medicare finally came. But the price in lost resources is very high.

We are not proposing here that the "possible-later" items be forgotten. They need their own special attention.

Rather we are saying that a misapprehension of relative time sometimes causes us, in our yearnings, to skip mentally over many

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<sup>7</sup>John A. Carver, Jr., Under Secretary of the Interior, in speech to Eighth Orientation in Politics Conference, The College of Idaho, Caldwell, Idaho, November 5, 1965.

intervening steps and to look upon the future as obeying our purposes today. Thus, unwittingly, we equate goals attainable today with those attainable only tomorrow, and place both in the scales at once.

Walter Lippman says:

"The future is the most illusive time of all. It is hard not to picture the future as if it obeyed our present purposes, to annihilate whatever delays our desire, or immortalize whatever stands between us and our fears."

The fifth commandment, "Utter that which can be comprehended," is no plea for simple, fog-free writing, although clear communication is essential.

Instead, it is a command to transmit messages on frequencies to which receivers are tuned.

Merely uttering that which *we* wish to say, though we do it with the latest, most exciting technical and mechanical means available, does not result necessarily in communication.

Such messages must be translated into words, symbols, and concepts that are meaningful to the grass roots. The messages must take into account the complexity, the variety of economic station and need, and the independence of mind of the grass roots. For example, exhortations to give up beef steak and switch to rattlesnake have little impact on persons who crave beef steak, who fear rattlesnake, and who cannot obtain rattlesnake. Eventually the switchover might come. But the cause might surprise us.

Max Planck, the physicist, put it this way: "New scientific truth does not triumph by converting its opponents and making them see the light. It triumphs because its opponents eventually die."<sup>8</sup>

Uttering that which is comprehensible means knowing the grass roots well enough to apprehend what they are most likely to be able to make a part of their own minds. Hunches are unreliable guides. Research at the grass roots is the surest way to learn how to transfer meaning at the grass roots.

And meaning is changing at the grass roots. Edith Shedd, reviewing the motion picture, "Wild Rivers," wrote:

"I can't get out of the superlative degree when I write about this film. There's something . . . unusual about it. It was produced by Humble Oil Company, the folks who put tigers in gas tanks. It was done in cooperation with the federal agencies involved with the outdoors. Now, to put business and recreation/conservation people on the same team is a new twist. In all the old scripts they played on opposite sides. Which one was the good guy and which the bad guy

<sup>8</sup>Max Planck, from *Scientific Autobiography and Other Papers*, "A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die and a new generation grows up that is familiar with it."

depended on your point of view. Not any more. This is the new conservation."<sup>9</sup>

So let's sum up by rolling all our commandments into one—listen before you talk, especially about conservation, to the grass roots.

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## COMMUNITY CONSERVATION

THOMAS OSMER

*Michigan Department of Conservation, Lansing*

We all know that a person learns more quickly and retains longer what he learns when the process of doing as he learns is involved. I would like to tell you how we are applying this knowledge in Michigan by using what we call "Community Conservation" as an effective way of illustrating to the layman simple but basic principles of natural resource management—conservation education at the grass roots.

I would like to show you how we are using this means of persuasive communication in pointing out to the public practical management and sensible use of natural resources—or, if you prefer, conservation.

We have found that one of our most effective aids in this effort is the "Community Conservation Project," for it involves people—people taking an active part in conservation work; hence, people enriching and expanding their understanding of what is involved in the management and administration of natural resources.

But let me show you briefly, by means of a few examples, what we are doing about this in Michigan, especially on some of the game areas and recreation areas within 50 miles of Detroit.

### HOLLY RECREATION AREA

The Holly Recreation Area, 35 miles north of Detroit and 15 miles south of Flint, was the scene recently of two major Community Conservation projects. This recreation area, one of several, includes about 6,000 acres of land open to hunting, fishing, and general recreation. These particular Community Conservation projects were spearheaded by the Oakland County Sportsmen's Club, the largest club in the county, with a membership of about 1,500. The first project was the construction of three duck ponds primarily for the benefit of mallards, black ducks, and other puddle ducks, common to this part of Michigan.

Before the earth-moving equipment could be used, a fair amount of clearing had to be done. Along with the men who took part, several

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<sup>9</sup>Better Camping, Kalmbach Publishing Company, September-October 1965.

members of the Junior Oakland County Sportsmen's Club volunteered to help. Fortunately, several members of this Sportsmen's Club are members of the Oakland County Excavators and Earthmovers Association. This organization co-sponsored these projects with the sportsmen by furnishing several pieces of earth-moving equipment and operators. Technical direction, plus a dash of inspiration, was provided by Department game biologists. Other Department personnel from Engineering, Forestry, Fish, Parks, Information and Education, Law and Fire Divisions gave able assistance on these projects, too.

After the dams were completed, Game Division furnished farm equipment, as well as fertilizer, seed and mulch, which were spread by the sportsmen on the fills and other areas of bare soil. Soon the ponds were filled with water, ready for ducks. These are shallow ponds designed especially for puddle ducks. These ponds and adjacent food and cover patches were all put in in two days, Saturday and Sunday.

Another Community Conservation project done by these two organizations was the construction of more than a mile of road which now provides access to several hundred acres of recreation land for the benefit of sportsmen and the general public. Close to the road-building operation was a gravel pit. The owner of the pit furnished all of the fill material free of charge; not only that, he jumped on his farm tractor, equipped with a scoop, and spent most of the day helping to load dump trucks.

These Community Conservation projects—the construction of three duck ponds, food patches, and this road building job—would have cost the Department at least \$4,000. All it cost us was gas and oil for the equipment, and seed, fertilizer and mulch. This road job, like the duck ponds, was also done on a weekend.

Community Conservation projects like these are not "Work Bees." We have tried "Work Bees," but people don't care much about working on Saturday and Sunday. They want to play, have fun, relax. "Work Bees" fell flat. Community Conservation projects, on the other hand, are referred to as Outdoor Recreation Activities—hence they are FUN. When the job was done, the sportsmen left with a feeling of complete satisfaction in doing a good turn for conservation. Several remarked, "Man, when can we do more of this?"

A smaller but nonetheless worthwhile job in Community Conservation is creating openings in brushy cover. After field tile or other structures are laid for artificial dens, the brush is cut and piled on top, creating good rabbit cover.

Along with creating dens for rabbits, sportsmen built many nest

boxes in their basement workshops during the summer. In the winter we game biologists helped fasten them to trees in small duck ponds on game areas and recreation areas. They were put up in the winter because it was a lot easier walking on ice than in water. Being over water during the summer, these nest boxes are more predator-proof. Designs and details were secured from the U. S. Fish and Wildlife Service.

Community Conservation projects are not all clean and cool. A group of ten Explorer Scouts, along with their county Scout executive, grabbed fire fighting equipment and spent a long hot day last fall, fighting a fire on one of the game areas. The burn threatened several hundred acres which included five years of partridge research. The value of this type of Community Conservation project is difficult to measure in dollars and cents. Some of the adult fire fighters were surprised that teen-agers could work. I simply pointed out that these boys were not merely teen-agers; they were Explorer Scouts!

Community Conservation projects are for women and girls as well as for men and boys.

One group, with their adult leader, was a part of a local Senior Girl Scout Troop who, last spring, was working for a merit award in conservation.

Before they got busy, arrangements were made to have them talk with four of us Department men, including the district fish biologist, district forester, and a local game area biologist.

We discussed practical management of natural resources, with special emphasis on soil, water, fish, forest products, wildlife and game. However, the growing challenge of managing people in relation to natural resources took the major interest of the group.

Afterwards the Girl Scouts spent the rest of the day on a new dam we had built on one of the game areas for fish and ducks. They prepared the raw soil, then after lunch in the field, they spread fertilizer, seed and mulch. It was a cold day. They did a good job. We gained from their help and interest. They gained seven hours of credit each toward their Conservation Award—(a total of 50 hours per girl is required). They also gained a broader understanding of the management and the administration of natural resources.

#### LAPEER STATE GAME AREA

Other Community Conservation projects are being conducted on state game areas. The Lapeer State Game Area of 7,000 acres is 20 miles east of Flint and about 50 miles north of Detroit.

A day or two following this past Christmas found a large gravel truck and trailer pulling into the game area, filled with unsold

Christmas trees from Detroit. It was led by members of the Detroit Outdoorsmen's Club, who for the last several years have used this Christmas tree project as one of their winter activities.

Helping the Game Biologists, they made brush piles on pre-determined locations, primarily for the benefit of rabbits. The truck and trailer were furnished by the sportsmen. Again this is not called a "Work Bee." This is a winter Outdoor Recreation Activity. Many of the men brought along their sons, their beagles and their guns, and after the Christmas tree brush-pile detail was finished, they spent the rest of the day hunting on the game area—an excellent place for rabbits. You see, when work can be combined with pleasure, it's *fun*. It's Recreation.

Such projects as these stimulate interest in conservation-related clubs, often result in increased membership, and create a more vigorous and healthy organization. They also provide an opportunity for a better understanding and appreciation of the layman's problem and points of view by the professional conservationist.

Not all Community Conservation projects involve physical work. Some can be accomplished by merely digging down in the pocket and providing money. An electrically operated fish weir was installed by the Fish Division to stop carp and other undesirable fish from getting into some nice panfish lakes. When the word got out that the Fish Division didn't have the money to operate the fish weir last year, residents who lived around these lakes got busy. Twenty of them reached into their pockets and came up with the necessary \$400.

Business and professional men from Flint are working with Department game biologists in a Community Conservation project involving partridge research on the Lapeer State Game Area. Each Flint man teams up with a Game man, and with their dogs and guns actually go out and hunt during the hunting season on that part of the game area which is under partridge management and study.

We call this game research down the length of a gun barrel. They hunt for a total of 10 hours at specified times. It takes 4 half days of the sportsmen's time and over 200 miles of travel in their own cars.

And so, as you have seen, Community Conservation projects not only provide means for conveying practical conservation principles, but such projects also provide hunting and fishing opportunities—and happy sportsmen!

#### DISCUSSION

MR. WALTER S. BOARDMAN (The Nature Conservatory, Washington): My remarks are based principally on the other speaker, but also on the conference, in general.

In the opening session, on Monday morning, there was a very interesting



discussion on pollution, and the representative of a very large youth organization stood up and said, "What can we do to help?" And his request was public.

And yesterday a speaker again followed through in a session, said, "What can an individual do to help on this?" And there was no good answer. This matter of information involves specifics on how service groups and individuals can help. What are the materials? What can a Girl Scout Troop do? What can a council do on air pollution or on conservation and any of its phases? What can a school system, what can a superintendent do? What can he present to his faculty? What can they teach?

I don't mean just a little magazine with some nice pictures, but some specifics as to how groups can help when they want to. We talk enthusiastically to each other. We say something can be done, but when it comes to, well, now, what can we do, we say we have to go on to the next question.

DISCUSSION LEADER CHAPLIN: Thank you, sir. I think what you have just said is right to the point, and it ties right in to what Tom Osmer has described.

DR. J. HAROLD SEVERAID (Sacramento State College, Carmichael, Calif): I would like to comment, just briefly, on both Mr. Kline's and Dr. Osmer's papers.

In the first place, Mr. Kline made the statement, something to the effect that the groups planning to represent grass roots, did not, in fact represent them. They represented the point of view of a group.

I would like to point out that there are many cases when a few visionary people can, in a sense, sense the feeling of the grass roots, and if the grass roots themselves don't know it, they quickly recognize it when the problem is pointed out, and they join in wholeheartedly. We have to have groups who are far-sighted enough to do this type of thing if we are going to succeed in some of these conservation projects. A given illustration of how this works in our own community in Sacramento County will give an example of how people can help themselves.

In relationship to this, let me say that the question just posed by the last commenter, who said in effect that the community or the people want to help, this was asked at the White House Conference, and I think at several state conferences on natural beauty, since. I would like to point out that in our Sacramento County, California, the county supervisors have on three previous occasions over the last twenty years, made an attempt to set up the American River Parkway Plan. This involves a 23-mile strip of the lower American River going through metropolitan Sacramento.

They wanted to make a green belt-type park, and three times the thing had failed. I want to emphasize the fact that it had not succeeded, because, when it got down to the hard facts, there was a lot of opposition, and absolutely no people standing up before the supervisors and saying, "Yes, we want to do it."

The last time they tried it, which was in 1961, a group of us got together and decided that this time there should be public support for this particular project, and as a consequence, we formed what we called the State American River Association. In a matter of about two to four months of public speaking, we had at that point some 1200 private citizens as members of our organization, authorizing the group to speak for them.

We also had 45 co-sponsoring organizations of conservation organizations, all types in the community, including not only conservation groups, but Rotary Clubs and all kinds of service clubs and organizations.

We stood before the supervisors and pointed this fact out. That was exactly what they wanted in the first place, public support. This plan was adopted, and without any hitch and without any verbal opposition, when the final hearing was held, and the plan is now a part of the over-all county master plan. So here was a case where an anticipation of what the grass roots intent ought to be was quickly implemented, and the grass roots support was there.

And in line with what people can do, we have subsequently carried this point of view one step further. We have set into motion what we call an "elbow room project." Many of you have seen me wearing a button marked "an elbow room

broker." This is reflected in this project, where we are trying to show the people how they can recognize the value of the recreational dollar. So we are currently underway with our so-called "elbow room project." We took an option on a half-mile river front within this parkways concept and geographical area. We are selling elbow room or standing room, one square yard per dollar to the people. They are making the donations, getting little deeds in return, and so on, and when this money has been collected, we will then take title to the property and turn it over to the county, and they will administer it in perpetuity.

The thing I would like to point out is that when county government buys land for recreational purposes, they never bother to break it down and show people what they are really getting for their money. It is just a big huge figure that stands out in print, and everybody thinks this is a very costly project. But when they can participate in it themselves, and recognize the fact that there are standing room costs of only a dollar, you pay as much as \$4,800 an acre, because there are that many square yards in an acre of land. Under circumstances like this, they can quickly be informed of the fact that all they have to do is stand on that land once for an hour, and they get their dollar's worth, yet it is there for time immemorial for as many people who want to use it. You can put this project on. There are a lot of groups in California that are stronger than we are. On January 11, we already had over half the money collected. We have no question at all but what we will succeed in this project, and the people certainly will recognize the fact that they're doing something for themselves as individual citizens.

MR. KLINE: I think the gentleman who just commented has given us a good example of the thing that I was talking about. There is not enough time in this meeting here, for me to go into all that I could say about grass roots public relations, as applied on the local scene. This is where it does work out.

I didn't get into case studies on purpose. I thought the general principle here would apply more to everyone than to go down a list of case studies.

When you asked, or implied that I have been up here talking about a lot of impractical stuff, and then say, "Tell me how I can apply it in my community," you've put me in the position that one of the speakers was in, two years ago, in this meeting when he said, when the question was posed to him, "Well, that is sort of like being asked in school to describe the universe in ten words or less, and give three examples." You just don't have time to detail how to do this, locally. I will do this individually at whatever length anybody wishes me to, if I can know enough of your situation.

Now I know that there are groups who go out and advocate ways to do a thing like the gentleman described, and this is fine. Nothing I said was intended to conflict with that. What I meant was that public relations at the grass roots sometimes will identify opposition to projects that is so entrenched and so bitter that you are just wasting your time and hurting the general cause of conservation, because you haven't turned into cubic yards of earth, as the gentleman said, the message that you are trying to get across.

So go and listen first, and then perhaps you can get what you want done much quicker and with less effort and trouble. Thank you.

DR. J. J. SHOMON (National Audubon Society): I can't let this opportunity pass without offering a word of encouragement to my colleague, Dr. Boardman, and to all of you who are here who are made acutely aware of how important it is to transform conservation interests into action. I can tell you that a lot of us in the conservation education field are very seriously concerned about this. For the last three years, several organizations have banded together to put together the best set of guidelines on conservation education action that I know of, and this set of guidelines is going to be available to anybody who wants it, at cost, I hope, by the end of June. And it will be available through the Izaak Walton League of America, which all of you know has been in the forefront of conservation battles in this country. The beauty of the league and the chapters and so on is, that they are an action group. It has the support of the Conservation Education Association and

the National Audubon Society. So I think you will find in that publication, at least some partial answers to this problem that we are talking about this morning.

DR. OSMER: I'm very glad to hear about that guide coming. We can certainly use it.

DR. ARCHIBALD COWAN (University of Michigan): Tom, I would agree that your type of projects are all too few in the conservation scene. I would like to ask a question, though. In view of the recent discussion that has been going on in the state regarding the deer management program, could you give me any indication of how many of these people who work on your project wrote to Senator O'Brien and Representative Snyder, supporting the department program, and conversely, how many of them had their names on the petitions to abandon the department's program?

DR. OSMER: The answer to that one, Dr. Cowan, I can't tell you. I don't know. We should have a check sometime, and find out how many people take the advice or suggestions to write to your legislator.

I don't know how many of these people that we were working with on these community conservation projects talk with their local representatives. I think, of course, that the sportsmen's groups could do more on that, and what they may have or may not have done, I think would show up within the next year or two, on our current problem, which goes on in Michigan, apparently, forever and ever.

I'm glad that we have problems, of course, in conservation. Otherwise, it wouldn't be exciting.

I don't want to leave you people with the impression that that is all we have ever done in Michigan, or that we just started a few years ago. I have a few reprints available up at the table, taken from an article appearing in the January-February, 1966 issue of "The Michigan Conservation Magazine". It is simply entitled, "Community Conservation." I would like to take another second or two and refer back to a request we had in April, 1965 to bring up to date what has been done in various districts. We had community conservation projects in the district that I live and work, long before we had these.

For example, we had a very excellent community conservation project in 1954. We took full advantage of the Scout theme that year: "Conservation." We had the Tall Pine Council based in Flint, which involves three large counties, there. At that time, there were 4000 or 5000 Scouts. We had over 500 Scouts and their adult leaders and scouters at hand.

We have had 17 of them since 1954, involving all the way from ten people on fire fighting, up to the 400 or 500 that we had there at the Council Camp Arena.

## QUALITIES OF CONSERVATION MATERIALS

CARL S. JOHNSON, DAVID L. ERICKSON, and CHARLES A. DAMBACH  
*Natural Resources Institute, The Ohio State Univeristy, Columbus*

The study proposes to determine factors which control the effectiveness of conservation-education materials. These include distribution systems as well as qualities and quantities of materials. The major objective of the study is to determine ways of making the efforts to assist conservation education by way of materials more effective, hence the title "conservation-materials conservation." The emphasis is on the materials prepared for, distributed to, or made available to schools.

We asked 2,408 potential sources for copies of "free and inexpensive conservation-education materials prepared for or sent to schools." We later visited about 100 of the producers of such materials to determine the amount and nature of materials we might have received had we visited all sources.

We deliberately did not attempt to define either *conservation* or *conservation-education materials* other than to say "free and inexpensive." We wanted to see what we would get without defining conservation or setting limits; we have found that the composite definition is broad, to say the least.

We now have spent nearly two years sorting and analyzing the nearly 8,000 different pieces of materials received. This reports some of our findings. We propose to find out how much such material there is, which resources get least attention, and what the cost of the total production may be. More important, we intend to assess the qualities of these materials, and to find out what characteristics of materials and distribution systems would seem to create the greatest amount of teacher awareness and use of conservation materials. We want to help get better use of conservation-education materials.

### THERE ARE PROBABLY OVER 20,000 PIECES AVAILABLE

When we say we have 7,950 pieces, we are not counting each issue of periodicals; we are counting TITLES—a periodical is only one title no matter how many issues we have. The 7,950 titles we have received are sorted into five major categories :

Materials addressed to teachers .....	652
Materials addressed to students .....	829
Addressed to the "general public" .....	4091
Addressed to managers .....	1845
Publication lists not yet sorted according to audience addressed	540
<b>TOTAL</b> .....	<b>7957</b>

<sup>1</sup>Project Conservation-Materials Conservation is sponsored by the Cooperative Research Program of the U.S. Office of Education and The Ohio State University.

We received nearly 5,000 of these materials in response to request mailed to nearly 2,300 potential sources. We thereafter made personal visits to over 100 responding sources; state agencies in 11 states and over 50 agency or organization offices in Washington D.C. From these producers of materials we had received 1,305 pieces by mail; we received 4,436 pieces by visitation to the same producers.

If we multiply the resultant visitation-to-mail ratio, 3.4:1, by the 4,720 total received by mail, we get the round number 16,000. That we believe is the minimum total titles available. One of our extrapolations yields 5,000 conservation materials from state extension offices alone! Our data will support an estimate of over 20,000 titles related to the management of natural resources.

WE RECEIVED A HIGH RESPONSE

We mailed nearly 2,300 requests for materials. Federal agencies yielded the highest returns; 93.5 percent. We received replies from 1,617 of the 2,272 places addressed, a 71.2 percent response. To these are added 136 additional sources for a total of 1,753 responses. This is a large number and a high response; 73 percent. A great many of these responses were negative; they told us that they did not produce or distribute any materials on conservation.

An examination of the graph (Figure 1) whereon addresses are

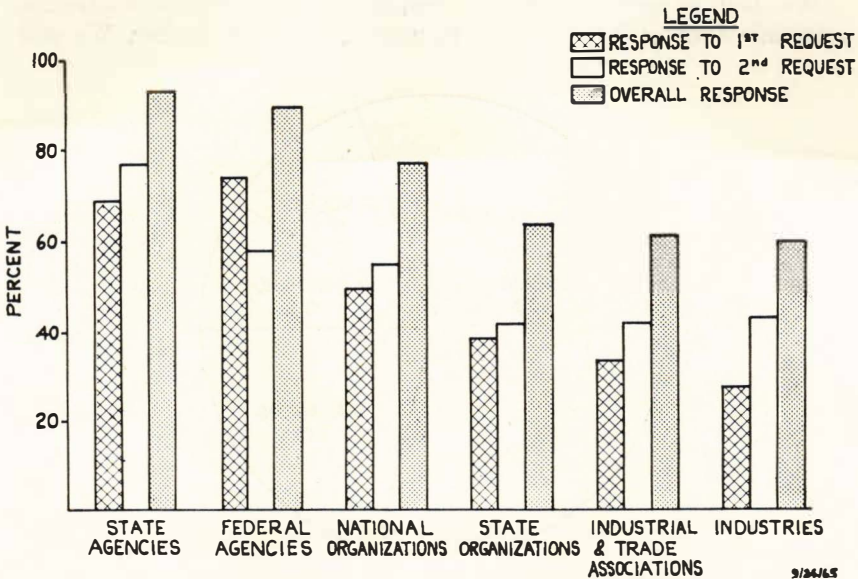


Figure 1. Response to 2,272 mailed requests for materials

arranged in order of percent of response reveals two rather interesting facts. One, the percentage of response to a second request for materials was higher than response to the first. This may be a phenomenon well known to advertisers and bill collectors! Second, industries produced the lowest response. The response from 1,039 industries was 60 percent. Industrial and trade associations were not much better. This seems contrary to general impressions. We need examine the materials we received from industry to see if, as we now suspect, there is an appreciable difference between the conservation attitude of industry and that of other producers of conservation-related materials.

**MOST OF THE MATERIALS ARE FOR THE GENERAL PUBLIC**

Most of the material is addressed to the general public. (See Figure 2.) Only one-fifth of the materials can be said to have been prepared specifically for conservation education in schools. This is about evenly divided between materials addressed to teachers and materials addressed to students. Twice as many pieces in our collection are addressed to managers as are addressed to teachers or students and six times as many pieces are addressed to the general public. This is as was hypothesized; most materials are "shotguns" instead of "rifles"; that is, they are addressed to everybody. We expect to prove that this is inefficient for conservation education.

We had expected that the proportion of technical materials, materials addressed to resource managers, would be higher. We still

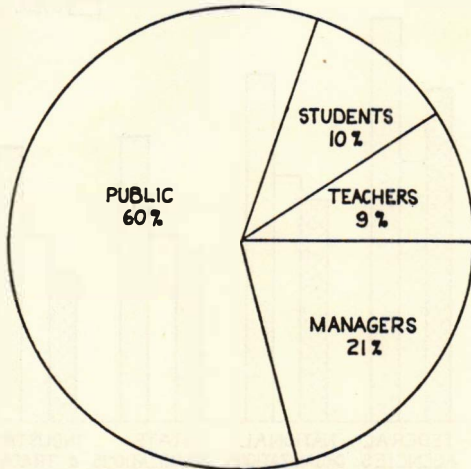


Figure 2. Audiences to whom materials are addressed.

think that in the total of over 20,000 titles the percentages of materials addressed to resource managers is higher than the 23 percent in our sample. Our request for "conservation materials prepared for or distributed to schools" was a selective factor causing the elimination of much of the technical materials.

#### FREE AND INEXPENSIVE MATERIALS ARE EPHEMERAL

Our form requests asked for materials produced in the years 1959 through 1963. These dates were generally ignored; we were sent whatever was available.

About one-third of all the materials we have is undated. In this respect there are notable differences between groups of producers. Nearly all federal-agency material is dated. It seems that industries and industrial associations may tally a higher proportion of undated materials than do any other groups of producers. However, organizations, both national and state, also put out a great deal of undated material.

Materials dealing with animal resources, primarily the "wildlife" materials, are more often undated than are materials dealing with soil, water, or minerals.

Some agencies avoid dating materials because they believe the material will be usable longer if not dated, that placing a date on free and inexpensive materials hastens their obsolescence. On the other hand, we have learned from other producers and from users that dating assures a longer period of usefulness because one does not have to wonder about the time factor.

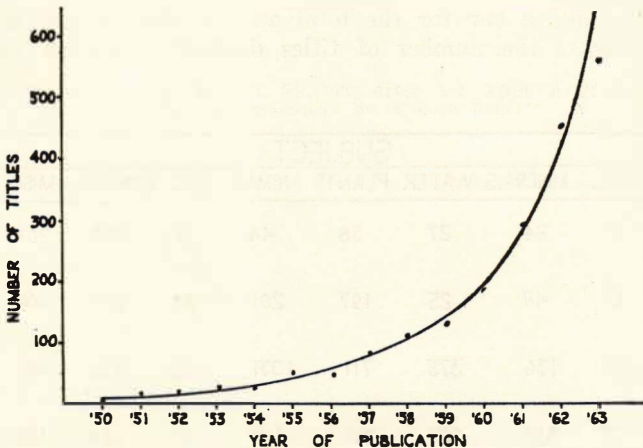


Figure 3. Distribution of 1,975 dated materials received as of October 1, 1964.

In any event we have found that materials tend to be exhausted before they are outdated. We tallied the publication dates of nearly 2,000 pieces. (Those data are shown graphically in Figure 3.) If one starts with the datum for 1963 and assumes that the number of pieces produced each year prior to that has not varied greatly from year to year, one notes that the number shrinks about one-half for every two years of publication age. One may say that the "half-life" of free and inexpensive conservation materials is about two years.

SOME SOURCES ARE SLIGHTED

We did find that some resources have received much more attention than have others. (See Table 1.) The category "general" includes all material that gives nearly equal attention to two or more natural resources; it accounts for 10 percent of all materials. Only 5 percent of the materials addressed to the general public is classed as "general" while 40 percent of the materials addressed to teachers deals with more than one resource. Materials prepared for the general public tend to deal with only one resource; materials for teachers tend to deal with several resources.

The table (Table 1) corresponds to the sorting scheme we have used for handling and filing materials. There are 32 sorting categories, first sorting by audience addressed and then by resource treated. Note that there are eight sorting categories in which we have tallied less than 50 titles; teacher materials on soil, minerals, water, and recreation, and student materials on water and recreation. The basic natural resources, soil, water, and minerals, have fewer publications than do plant resources and animal resources.

We have made a bar for the total and divided it into portions corresponding to the number of titles dealing with each resource

TABLE 1. DISTRIBUTION OF 7,319 TITLES BY SUBJECT AND AUDIENCE\*  
 (\*Count made as of September 15, 1965)

AUDIENCE	SUBJECT								TOTAL
	SOIL	MINERALS	WATER	PLANTS	ANIMALS	REC.	GENERAL	MISC.	
TEACHERS	11	24	27	58	44	22	260	207	653
STUDENTS	54	48	25	197	201	33	106	106	770
PUBLIC	291	136	375	711	1031	1098	236	495	4373
MANAGERS	79	352	267	311	110	97	154	153	1523
TOTAL	435	560	694	1277	1386	1250	756	961	7319



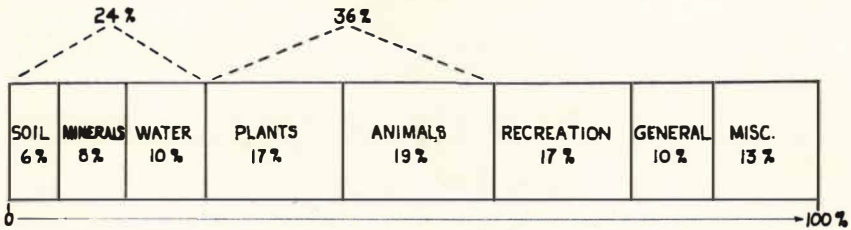


Figure 4. Distribution of 7,319 materials by subject.

category (See Figure 4). Soil receives least, a mere 6 percent, followed by minerals with 8 percent and water with 10 percent. The three basic natural resources share 24 percent of the total titles; plant and animal resources together have 50 percent more, 36 percent of the total titles. We believe there is an imbalance in this distribution.

We had hypothesized that minerals were the neglected resource. We found that soils can be said to be the more neglected. However, when one examines the audience sorting of the materials on the basic resources one finds that 62 percent of the materials on minerals are technical publications and that nearly half of the materials on water are also technical. It is quite obvious from our data that soil, minerals, and water receive less attention than do the other resources.

WHAT IS CONTAINED IN CATEGORY "MISCELLANEOUS"?

Are there no materials on air pollution? Many have asked us about materials on new problems such as radioactive wastes, air pollution, land-use planning, and population control. We find very few materials on any of these conservation problems. Figure 5 shows the distribution of 961 pieces in our sorting category "miscellaneous." Note that air pollution constitutes five percent of that category, a bare one-half of one percent of the total. Population control receives even less attention.

Most of the materials on air pollution is technical. The same generalization that may be made about materials on air pollution may be made about other new or more recent conservation problems: *There is a considerable time lag between awareness of a problem and the production of materials on that problem for use in schools.*

The largest single group of materials in the miscellaneous category is on health and safety. These came to us as materials dealing with "human conservation." They constitute only about two percent of the total. We had certainly provided opportunity for health materials to be introduced into our collection for we not only addressed all state

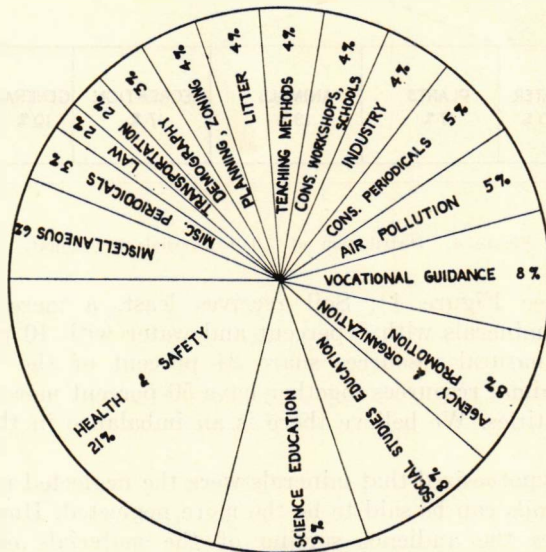


Figure 5. Content of category "miscellaneous."

departments of education but also state departments of health. Most of the latter sent us their materials on water pollution, but only a few send us materials on health.

#### CATEGORY RECREATION IS GROWING

A year ago we tallied the distribution of 2,261 dated titles by three-year periods. We wanted to see if there was any significant shift in the proportion of publications devoted to each of the natural resources. Our tally is shown graphically (in Figure 6). The category "general" has increased very slightly. Soil, water, and minerals have stayed about the same. The proportion devoted to plant resources has shrunk. Recreation is the growth category.

#### FEW MATERIALS ARE PREPARED FOR ELEMENTARY STUDENTS

We have measured the relative readability of over 4,000 pieces of material. The system does not pretend to determine the grade level for material; it does give a measure of relative readability. The Dale-Chall system gives *Reader's Digest* articles a mean rating of nine.

We have graphically shown readability for nearly 4,000 pieces in Figures 7 and 8. Each bar represents the percent of that audience's materials for each readability level, 4-16. The modal readability level for materials prepared for students is eight. The mean is nine. Only about 18 percent of the total of materials addressed to students has

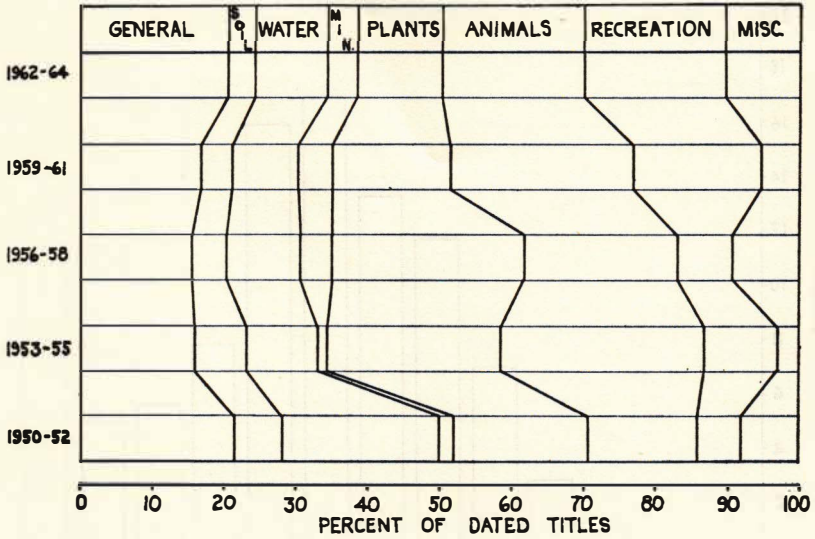


Figure 6. Subject distribution of 2,261 dated titles over a 15-year period.

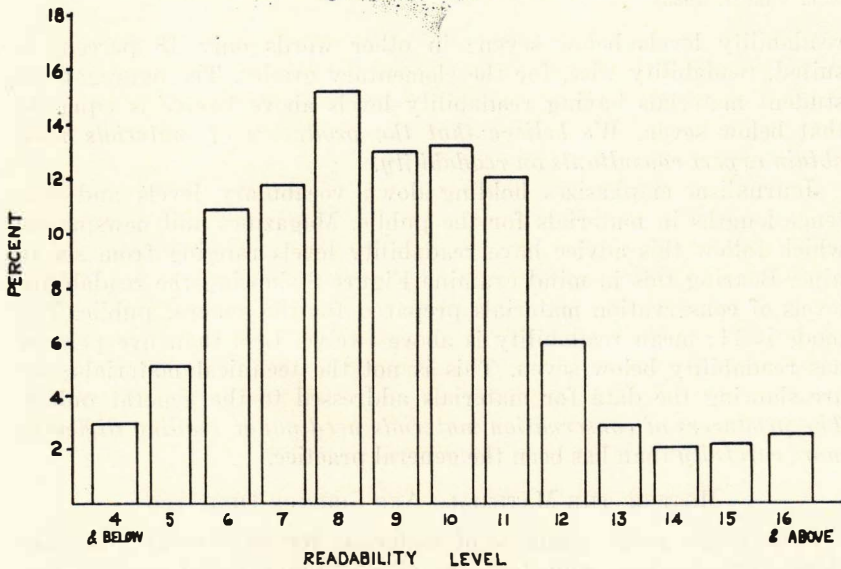


Figure 7. Readability levels of materials prepared for students (determinations made as of June 1, 1965).

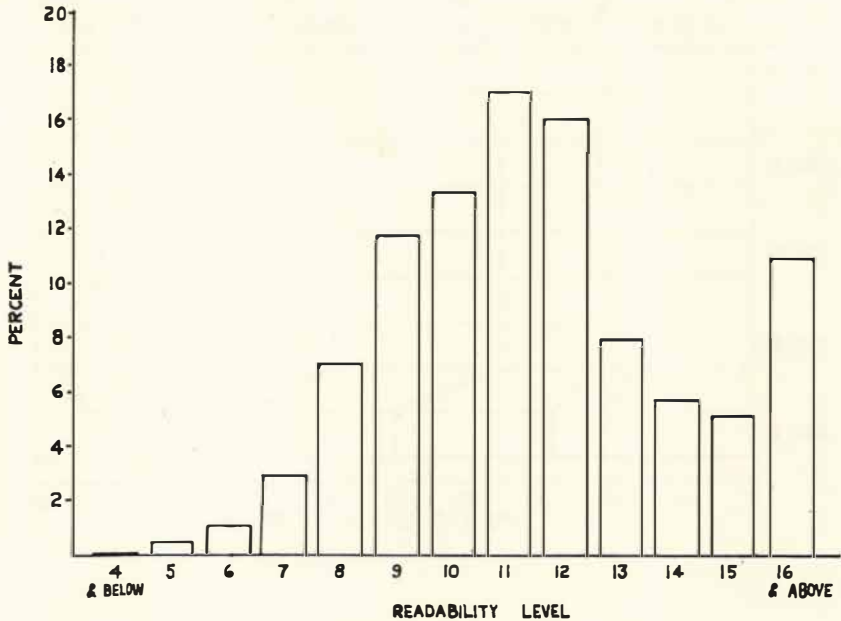


Figure 8. Readability levels of materials for the general public (determinations made as of June 1, 1965).

readability levels below seven; in other words only 18 percent is suited, readability wise, for the elementary grades. The aggregate of student materials having readability levels above twelve is equal to that below seven. *We believe that the producers of materials need obtain expert consultants on readability.*

Journalism emphasizes holding down vocabulary levels and sentence lengths in materials for the public. Magazines and newspapers which follow this advice have readability levels ranging from six to nine. Bearing this in mind examine Figure 8 showing the readability levels of conservation materials prepared for the general public. The mode is 11; mean readability is above twelve. Less than five percent has readability below seven. This is not the technical materials; we are showing the data for materials addressed to the general public. *The producers of conservation materials need gauge reading difficulty more carefully than has been the general practice.*

#### MOST OF THE MATERIALS ARE SCIENCE ORIENTED

Consultants judge qualities of materials for us. Among them are elementary teachers and teachers of secondary social studies and secondary science. They were judging teacher-use of these materials.

We have not run a statistical analysis of their judgments, but we can report that their subjective judgment of the materials corresponds with judgments made by two other groups of quality judges. One of those groups is made up of resource specialists; they judge information quality of material. The second group is professional educators: they judge educational acceptability or potential. All have reported that:

1. Most of the materials are of poor or mediocre appearance.
2. Bias is at least as prevalent in governmental-agency materials as it is in organization and industrial materials.
3. Only a fraction of the materials addressed to students is well oriented toward both curriculum and audience maturity.
4. Very few materials are directed to or oriented for the social studies; most of the material is science oriented or assumes that science is the subject in which conservation is taught.
5. There are some excellent materials.

#### THERE ARE SOME EXCELLENT MATERIALS

This paper has pointed out shortcomings of conservation-education materials. We must admit that we have many excellent materials. We are not yet ready to report on these or on the characteristics of materials that may be expected to result in teacher acceptance and use. We can hypothesize that attractiveness is at least as important as is information quality. This hypothesis certainly is not original with us. We are getting some interesting data with respect to the effect of attractiveness of appearance on teacher evaluation of materials.

We have hypothesized that quantity and system of distribution are factors that are just as important as are material qualities. We have plans for testing these hypotheses. Many among you may be involved in the study in connection with the testing of teacher awareness and acceptance of materials.

Materials produced by industrial associations may win many laurels. Certainly they are among the most attractive. They also yield evidence of the work of or consultation with professional educators. With the inference that you may make from that remark we conclude this progress report on the conservation of conservation materials: *you who deal with the management of natural resources stress the need for consultation with professionals. It would be well to practice that preaching in the preparation of materials for conservation education.*

#### DISCUSSION

DISCUSSION LEADER CHAPLIN: I think he has outlined some failings of our publications activities. There must be somebody here who would like to defend himself. Why do we aim things at recreation and animals?

MR. JOHN VOSBURGH (Editor of *Audubon Magazine*): I noticed in the last speaker's enlightening report that editors were not among those receiving the avalanche of material. I presume, of course, they were included in the public category.

The pertinence of the conservation materials concerns me, in that there seems to be a lack of timely conservation releases dealing with crucial issues of the day. I refer specifically to the fact that we were informed at this conference that attendance at the billboard hearings at the Bureau of Public Roads are running 18 to 2 against conservationists.

The outdoor advertising people and billboard people are cramming these regional conferences, and this seems to be a deficiency somewhere in the communications process. Now, in the democratic process, if we are to follow the public will, which resulted in the passage of the Roadway Beautification Legislation, we should follow up.

I don't know if it is the fault of the press or of editors or of the conservation organizations, but somewhere we are not getting the message across that the individuals and these organizations should attend these hearings, should be qualified to speak on the legislation, not emotionally against billboards, but qualified to speak on the legislation, and even though the bill is somewhat watered down, support the Bureau of Public Roads' efforts to gain public sentiment in the various regions of the country.

DISCUSSION LEADER CHAPLIN: Thank you. I think I should like to rise to the defense of animals and recreation insofar as there seems to me to be an application which probably happened by accident, rather than design, to prepare these materials in relation to the public's comprehensibility, if that is the right word, and public interest.

Carl, do you disagree with me, there?

MR. JOHNSON: One of the earlier speakers said that cheesecake was out, but we believe a great deal of this flood of stuff on animal resources is conservationist cheesecake.

MR. GERALD SCHNEIDER (Girl Scouts of the United States of America): On this particular study that was done, we have a statistical survey which, in one sense, has taken a negative attitude. What I would like to know, and I think it would be most helpful, is: What publications did you people find in that Ohio study that were the most helpful, and where can we find out, or at least, have a knowledge of what these publications are, so we can study them to learn better what we should be writing and the kind of materials we might be writing?

MR. JOHNSON: The question is a very fair one in that we are, at this stage, better able to report on some of these somewhat simpler negative things than we are on the more positive ones. We are in the process of testing teacher awareness and acceptance, and in that manner, find out what the market will accept or use in materials. And it is from analysis of that data that about one year hence, we can report on what kind of quality to build in.

## A SOLUTION TO OUR PROBLEMS IN PUBLIC RELATIONS

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### INTRODUCTION

With a title such as this, you can assume that I believe we have problems. Most administrators and other workers in the natural resource professions would agree. Many management ideas which are sound are never put into operation because of "poor public relations." Conversely, however, many failures of unsound biological proposals also are blamed on "poor public relations."

A good public relations program requires two things: (1) a necessary job that is important, and is done efficiently and correctly, and (2) public appreciation of the effort expended and the results of that job. It is impossible for any business (and natural resource management should be so considered) to have good public relations without both of these components.

### THE PROBLEMS

Some problems that we face can be related to a poor job of natural resource management. But for the most part, the resource managers are capable, dedicated, trained professionals. However, their training may have been so natural-resource oriented that they fail to recognize the importance of "people management"; and they may not have acquired the knowledge or developed the skills to do the job.

It is true that some good public relations "just happens." This is the case in many of our natural resource management disciplines, including wildlife management. The good job of managing the resource, the past increase in size of many big game herds, the attainment of professionalism, and efficiency shown in operation, among other accomplishments, have done a fair job of selling themselves and the organizations involved. However, with increased human populations and the subsequently increased demands upon the resources, game populations probably will decrease, hunting areas will diminish in size and number, hunter success will drop, and the agency is "under fire." It is necessary to have a capable public relations operation to promote the ideas and sell the organization in light of increased demands that are inevitable.

Basically there are two types of public relations work. The first is a planned, organized effort at promoting the agency and its policies. This should be done by a few individuals with ability in public relations. It may require a long time. The second is a day-by-day

operation; an action, attitude, conduct program that involves every employee of the agency at all times.

It should be stressed here that it is impossible to have a good superstructure of public relations without a good foundation in natural resource management. Nor can there be an efficient, modern, growing industry without a good public relations program.

Therefore, let's assume a sound job of natural resource management, since this most often is the case. Thus most of the problems are associated with the second part of our definition, "the public appreciation part." Why do the many publics fail to appreciate the good work done by the management agencies? This probably can be answered with one word, a lack of "understanding."

Why don't these publics accept that the management principles which are advocated by conservation organizations are for the benefit of the people, who are the owners, as well as for the resource? The answer herein again is a lack of understanding.

It is human nature for people to be against the principles or ideas they do not understand or are not familiar with. And people do not understand because we either do not know how, or do not put forth the effort to explain the issues adequately or correctly.

Let us first assume we can communicate adequately, but do not. Why? Most natural resource professionals are just beginning to realize the importance of good communications and public relations. Heretofore it was something they didn't have to worry about. Now it is becoming accepted as important at all levels of the hierarchy, from director to steno, from biologist to manager.

But the big problem is that a majority of the natural resource professionals may try but do not know how to communicate or promote and sell their ideas. We have used strong-arm techniques of forcing regulations, seasons and issues down the throats of the publics so long that we don't know how to influence, persuade, or "engineer consent," in the jargon of the public relations expert.

The Information and Education function of the typical natural resource agency is not synonymous with public relations. I and E represents only one phase of public relations, a contact or a mass "spewing" of information for public consumption. Public relations includes audience research, planning, using the right method of communication in the correct way to achieve understanding, and having the proposal result in the desired action (which may be acceptance of an idea, or season).

Why audience research? It is necessary to do research on the specific public that you are trying to influence to find out who they are, what they want, and their stage of thinking regarding the issue.



Are they completely against it, favorably inclined, or uncertain? The degree toward acceptance or rejection would indicate the type of communications which would be most effective.

Further reason for research on the specific public is that each public must be handled differently. It would be foolish to use the same methods to sell a hunting season on doves or quail to a group of protectionists that you would use to promote the same season to a group of avid bird hunters. Deer hunters in Montana have different problems and ideas than do the deer hunters of Michigan. Characteristics such as religious beliefs, identity of leaders, prejudices, stereotypes, characteristics of age, and past experiences, among others need to be known about *the specific public*.

Some efforts toward influencing a public need be planned long in advance. These usually require constant evaluation and realignment before success can be achieved. The leaders of a public change as does their thinking, and plans also should change accordingly.

Good communications are more than just contact. Understanding is implied. We cannot measure the effectiveness of communications merely by counting the number of hours of effort or the number of people contacted. We judge communication effectiveness by measuring the "impact" on the people within the public concerned. It is easy to see that some issues require great impact and require the most effective method available. This might mean that in some instances a face-to-face exchange of ideas with a few people is best. Other times, ideas or issues may be in the early stages of planning or not particularly critical, and mass media methods can be used.

Another principle is that the internal publics, those included within the agency, as a unit must be behind any proposal. All personnel involved should have a voice in planning, but once the policy or proposal is accepted, they must present a unified front and not actively oppose the idea. This, too, is a matter of communications or "selling" the people within the organization through understanding.

Only too often the parts of an organization function as separate and distinct entities rather than pieces of a whole. It is like loading a shotgun shell. When all of the ingredients are present in proper amounts and in the right places, the product will be a success. When there is too much or too little of a component or it is improperly introduced, the whole shell can be a dud. Such is the way within a natural resource organization, and good communications and understanding provide the primer that sets off the powder.

#### THE SOLUTION

The solution is as real as are the problems. We need sound public relations programs as an integrated part of natural resource

management and capable men to guide them. It is time we quit expecting a biologist or a wildlife conservation officer to plan, administer, and carry out an effective, efficient P.R. program. We wouldn't expect a public relations expert to plan and administer an efficient waterfowl season, to solve the life cycle riddle of a parasite, or to do big game range analysis. He hasn't the proper training.

The natural resource agency should do one of two things—bring trained, capable P.R. men into the organization, or hire consultants. The latter course recently was chosen by the Colorado Game, Fish and Parks Department. I believe that this is a *first* for any state or federal natural resource agency! Perhaps it will only be a “stop-gap” measure until capable men in public relations pertaining to natural resource management can be trained.

As stated, the hiring of a consulting agency is one possible solution. Their personnel may be less biased, perhaps more authoritative, theoretically more objective, and certainly are more expensive. The most logical, most economical, most effective, and thus the most feasible solution is to have capable, informed men within the organization who can do the necessary public relations job. But these men must be trained specifically for that job.

Who is the best trained man for a public relations job in a conservation agency? I believe the ideal man would have a Bachelor of Science degree in a resource discipline and additional training with many courses in the arts of speech, journalism, and public relations. I say this because it is logical that an error in writing or speaking is less serious than an error in biological planning or knowledge. This man would be the P.R. professional, the planner, the individual who would evaluate each idea, season, or proposal in light of probable public response.

We recently inaugurated a non-research graduate program at Colorado State University that will allow the interested individual to gain the necessary knowledge in public relations while earning a Master's degree (Appendix A). Our first men will be available soon.

But how about the average resource manager, the man with a Bachelor's degree, the “Mr. Organization” to those whom he meets in the field? We believe these men, too, should at least be aware of the importance of good P.R. At C.S.U. all of our wildlife managers, fish managers, recreation managers, and watershed managers are required to take a course in “Public Relations in Natural Resource Management” (Appendix B) in addition to courses in psychology, sociology, speech, English composition and technical writing. In this course they are exposed to the principles of public relations and communications, including radio, television, photography, and popular writing. The

course has been well received, and approximately 100 students enrolled in it during this past academic year.

In addition to training students at the college level, we must incorporate public relations methods and stress the importance in our in-service programs *at all levels*. Workers must be cognizant of and accept the power of public relations and be prepared to implement the proper techniques in all dealings with people, from law enforcement to commission meetings. In line with this, we include the subject of public relations in our Game, Fish, and Park Commissioner's Short Course held annually at Colorado State University.

I believe the answer to our problems in public relations is education throughout all levels of status, experience, and training of natural resources management personnel. Education regarding the importance of a good public relations program, and education to facilitate the execution of that program are the solutions.

#### APPENDIX A

##### COLORADO STATE UNIVERSITY College of Forestry & Natural Resources

#### GRADUATE PROGRAM IN WILDLAND RESOURCE ADMINISTRATION

##### *Purpose*

The College of Forestry and Natural Resources has established a new graduate program in Wildland Resource Administration. This program is to meet a demand expressed by agencies responsible for managing natural resources and in anticipation of the growing need for resource managers with such advanced training.

Objectives of this advanced training program for the professional man are:

- (1) To give the natural resource manager an opportunity to broaden and to update his technical competence in his own field.
- (2) To broaden his training in related resource disciplines, thereby increasing his ability to work with the natural resource complex.
- (3) To strengthen his background in the areas of business, administration, communications, personnel management, public relations, and the social sciences which will increase his effectiveness as a manager or administrator.

The program will lead to a Master of Science degree. The holder of this degree will be a thoroughly competent professional in one of the natural resource disciplines. He will have a sound working knowledge of the overall natural resource complex and, in addition, a background in the administrative sciences.

##### *Need*

All resource management organizations (federal, state, local, and private) need personnel trained along the lines set forth in the statement of objectives. Much of this training must of a necessity come from experience and in-service programs. Nevertheless a formal program of study can provide a foundation on which to build and can be of tremendous value, particularly to a person who has had some "on-the-job" experience.

##### *Eligibility*

The program is designed for the person who has a bachelor's degree in one of the fields of wildland natural-resource management (fisheries, forestry, range,

recreation, watershed, and wildlife) or in a very closely related field. The final decision on eligibility would rest with the major professor in the field of study the potential candidate wishes to pursue.

#### *Course of Study*

The program leading to the Master of Science degree in Wildland Resource Administration requires satisfactory completion of a minimum of 60 quarter credits of graduate work. Although each student's program will be individually tailored to fit his background and needs, the following pattern of coursework is set forth as a guide:

- (1) No fewer than 25 quarter credits will be selected from the areas of administration, sociology, psychology, philosophy, business, economics, journalism, political science, public relations, and speech. No more than two courses will be allowed in these subjects from the College of Forestry and Natural Resources. This requirement may have been met in part by courses which could carry graduate credit that were taken in the undergraduate program.
- (2) At least one principles course in a minimum of five of the wildland resources fields, i.e., fisheries, forest, range, recreation, watershed, wood utilization, or wildlife management. This requirement may have been met, at least in part, in the undergraduate program.
- (3) A minimum of one statistics course carrying graduate credit.

#### *Other Requirements*

A committee consisting of at least three members should be chosen as soon as possible and no later than the quarter before graduation quarter. One committee member will be from the areas of social science and one will be from another major within the College.

A written report (professional paper) must be completed before the final oral examination can be scheduled. A maximum of 10 quarter credits may be earned in graduate-level research culminating in an acceptable professional paper. It is recommended that the written report should be concerned with natural resource administrative policies, problems, or situations whenever feasible.

An oral, final examination is required. A written final examination may be given at the discretion of the major professor. If administered, the written exam will be scheduled within four weeks after the start of the final quarter of work.

The general requirements pertaining to academic standards, maximum loads, and residency requirements are set forth in detail in the Graduate School catalog (available upon request). A minimum of 24 weeks of campus residence and 51 quarter credits earned at CSU is required.

#### *The Degree*

The Master of Science degree will be in the department in which the candidate does his major work. The area of specialization will be designated "Wildland Resource Administration."

The degree is offered in the following major fields of study:

- Fisheries Science
- Forest Management
- Forest Recreation
- Range Management
- Watershed Management
- Wildlife Management
- Wood Utilization

APPENDIX B

GENERAL OUTLINE OF STUDY

FS 101—Public Relations in Natural Resources Management  
 College of Forestry and Natural Resources  
 Colorado State University, Fort Collins, Colorado

Introduction and Definitions	—2 periods
History of Public Relations	—1 period
Types of Publics	—1 period
Internal Publics and Relations with Them	—3 periods
External Publics and Relations with Them	—3 periods
The Communications Process	—2 periods
Popular Writing and the Press	—3 periods
Examination	—1 period
Radio and Its Use	—2 periods
Television and Its Use	—3 periods
Public Speaking	—1 period
Development and Use of Visual Aids	—2 periods
Photography in Public Relations	—1 period
Slides and Motion Pictures	—2 periods
Special Events, Public Field Trips, Open Houses	—1 period
In-Service Schools, Extension Work	—1 period
Examination	—1 period
Learning Motivation, Group Processes	—1 period
Diffusion Process, Public Opinion, Social Action	—1 period
Persuasion, Propaganda, and Advertising	—1 period
The Public Relations Process	—1 period
Training of The Public Relations Man in Natural Resources Management	—1 period
Final Examination	—1 period

TEXT: Gilbert, D. L. 1964. Public Relations in Natural Resources Management, Burgess Publishing Co., Minneapolis.

DISCUSSION

DISCUSSION LEADER CHAPLIN: Dr. Gilbert has certainly hit on what to me, at least, is the heart of the matter. After almost twenty years as an I and E man, beginning as a professional public relations counsel retained by the fish and game department for five years before they decided to put me on the payroll, I can say I wish I had had the opportunity to study under him before I began. I think in the future, some years from now, we will see more people in the technical side and more people in the administrative side who grasp some of these points in public relations.

MR. JERRY LONGCORE (University of Delaware): I can see where a public relations man would be more effective if he were, say, a trained biologist with a broad ecological background rather than just a PR man. Would you like to comment?

DR. GILBERT: I rather anticipated this question. There is a lot of disagreement regarding the proper answer. I will give you my opinion. If I had to hire a public relations man to do a job for a game and fish department, I would look at the man who had the training in natural resources management first, and then additional training in the areas of the humanities, including public relations, perhaps at the master's level. The reason I say this, I think it is a lot better to make a mistake, to err in speaking or in writing, than in some of the basics necessary for sound resource management. Now this is my opinion. Some will not agree.

DISCUSSION LEADER CHAPLIN: I would disagree, just briefly. My feeling is, that if you have a public relations man in one office and you have a biologist and so forth in the other office, the only reason that that man in the outer office should

have a degree in wildlife management, for example, is if the people in wildlife management are incompetent and can't give him the straight facts.

DR. ARCHIBALD COWAN (University of Michigan): Doug probably knew that he wasn't going to get away from this without hearing a comment on this from me.

First of all, the experience has been, in the case of many, many different states, that it hasn't always been possible to create a sound management program without having prior approval from the public. I wonder if perhaps you haven't reversed your foundation and your superstructure.

DR. GILBERT: Arch, I think not. I would answer your comment this way. One of the first steps in any public relations effort should be simply that of having an audience with your public. As I indicated, find out where they are in this acceptance or rejection process. Getting their attention and making them aware of their situation, their interest, and then trying to sell them.

I would also say this. I think we have been doing a good job of natural resources management. You have to agree with me, I believe, that the professionals are well trained in natural resources management, but with increased interest, coupled with the increased use of our natural resources, I think we no longer can simply operate on the job well done. We have to have the public appreciation.

Now did I answer your comment or not? If not, maybe we had better get together.

DR. COWAN: We will have to do this separately, Doug. You use the Michigan deer hunters as one of the horrible examples in the problems we have been working on. This has been going on for decades, not just a few years. It has been going on for decades, and every so often, we have thought that we had this solved, but it only takes a little tip of the scales in the opposite direction, and you find that you have lost everybody somewhere along the way. And the immediate reaction you get is, "Well, the department hasn't been reaching the public." These accusations have been flying again this past year. If you will pardon myself for sticking my neck out on a couple of occasions, I went back over a good many years of departmental releases, and I found that the department had been saying in their releases, all along, the things that they had been accused of never having told the public previously. Some of the activities that they have been carrying on to educate the public, people who should have known that these opportunities were available, claimed that the opportunity had never been made available before. Deer yard tours, for example, are supposed to be a great new innovation this year. For at least five years there have been public releases giving dates and times of where these would go on.

Now I agree with you that information and education is not public relations, and I think that this has been one of our big fallacies in this game, all the way through, that we have been releasing material that has been read by people who want to read it. It is like leading a horse to drink, though. If he doesn't want to read it, you can't make him, in any way possible, read it, and it is the people who need to be educated, not those that want to be that we must reach.

We, as educators, are spoiled because we have people coming to us to be educated, or else they are in there because they have to get it in order to get through, so they have got to learn. But these people that are giving us the trouble are the ones that you can't make learn, if they don't want to.

This is where public relations is going to have to come into the picture, and just like any big industry, I think, we are going to have to create an image which public relations people, at the present time, say the Michigan Department does not have.

DR. GILBERT: Yes, Arch, I agree. I would like to say this. I apologize if it appears that I was picking on Michigan deer hunters. You know I have a strong affiliation, and I didn't intend to do it.

Public relations is like a toothache, I suppose. You never miss it until you don't have it. You should go to your dentist once a year.

I don't know whether this message is coming across or not, but you should be constantly on top of this problem. Anticipate it. Some of the efforts should be

long-range. It is not a one-shot deal. It has to be a constant operation, carried on and analyzed and evaluated almost day by day.

DISCUSSION LEADER CHAPLIN: I think what we are saying here is that the emergency occasion is not all there is to public relations, but I do feel that a good many public relations staffs should—and this is an accusation from our compatriots—be taking the leadership in public relations, because we are theoretically the nearest thing to public relations professionals that are on the staffs of fish and game departments. I think perhaps Dr. Gilbert will agree with me on that.

This teamwork that he mentioned in his paper, to me is vitally important. I think we need to realize that we have two professions at work here, public relations and natural resources management, and the administrator must be capable of acting as a catalyst to work these two together for the benefit of the whole program.

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## LET'S GET BEHIND THE THIRD WAVE BY REACHING THE UNCOMMITTED

CLINT DAVIS

*Forest Service, U.S. Department of Agriculture, Washington, D.C.*

If you considered all the information and education work done by all organized conservation groups, you would find it to be an enormous effort. Much of it is good and successful—but often in limited ways. Yet, I often think—and I believe you will agree—that in many ways the whole effort fails to reach its goal. It often fails to inform, educate, stir up and convince the general public, or the so-called man-on-the-street. I think there are reasons for this.

It is to explore ways to remedy this situation that I have a proposal to make to this group.

I propose that all conservationist groups call a one-year moratorium on meetings and information output where the audience is composed mainly of other conservationists. And during that one-year trial period, let us *redirect our major effort and energy*—all speeches and publicity—not at the family of professionals, but at broader publics which need to be informed and which we have not reached before, or do not ordinarily reach.

We are today in a conservationist's market. People today want to learn about conservation and do their part; they are more ready to accept the conservation message than ever before. Let us make the most of this changed climate and really get behind what someone has aptly called "Conservation's Third Wave."

The "First Conservation Wave," it has been pointed out, began with the Theodore Roosevelt-Gifford Pinchot era. For the "Second Wave," Franklin D. Roosevelt came along to give a vast new push to conservation. And beginning with the Kennedy Administration and

greatly enlarged by the Johnson Administration, the "Third Wave" is beginning to roll.

There are many reasons why we should at this time redirect our communications efforts at new, uncommitted audiences, including the general public—instead of continuing to talk to ourselves.

Let me mention a few :

1. Conservationists talk and write too much to one another. Let's quit mistaking the sound of your own oratory for the applause of the masses. In the main, our speeches and writing are directed at people who are already sold on our message. In the meantime we miss other groups and other publics who need to be sold.

Now you will recognize that this is not a new thought; others have said the same thing. If there is anything new in what I have to say it would be in the proposal to do something about it; take some action.

2. A new climate prevails in conservation today, quite different to what it was two or three years ago. Natural beauty is a popular political issue. It may become a close third to God and motherhood as undebatable. President Johnson's message to Congress last year on natural beauty was the most sweeping and dazzling document of its kind in American history.

Recently, a syndicated columnist, James Kilpatrick, who does not ordinarily write on conservation, wrote a column on the subject in which he said :

"All over the country . . . a new movement is gathering force that goes beyond traditional forms of 'conservation' or even of 'beautification'. In key places, men are thinking along bold and radical lines toward the preservation of open spaces; along highways and in the major cities, a mood is developing—not merely to create beauty but to ban ugliness."

Recently our First Lady who has done so much to spearhead the beautification drive, made this significant comment :

"My mail on beautification," she said, "used to come largely from people who were already believers. Today, it comes from people who are working on projects of their own and want to know about costs, and from people who are just getting interested."

Conservation was for a long time the concern of a dedicated few. But the President's message brought conservation into the city streets.

I think the people were ready for this change. In these recent years, many parts of America have become so ugly that nobody could help but notice it. The ordinary citizen did not need city planners to tell him how bad the stench in the Potomac was, or how intolerable the smog in our biggest cities, or that it made no sense to build the new



outer loop of the expressway through the only playground near his home.

President Johnson's call for clean rivers, clean air, city parks and trails and open spaces in cities has reached out far beyond the small band of dedicated conservationists. His tying "natural beauty" to resources conservation touched off a spark that has caught the public's interest. With this new spark, we who work in this field have an unprecedented opportunity to reach the larger public and make conservationists out of every citizen. Let us make the most of this new conservation climate.

3. In the last two sessions of Congress, there were numerous major laws passed in the field of natural resource conservation. No period in our history has been so productive in new "landmark" legislation. Yet how much does the public know about them? And not knowing, how much do they care? Professional resources managers and conservationists themselves have hardly digested this flood of new legislation. What an enormous job—and opportunity—there is here in explaining these new laws to the people.

These are some of the reasons why I feel that the time is ripe for us to redirect our information and education efforts.

This "Third Wave" can dissipate itself in confusion and lack of understanding to become no more than a ripple—unless the professional resource people break out of their limiting shell and match this great beginning with an equally great coordinated public relations effort.

Before I get into suggestions as to how we might *redirect* our efforts, let me say this: Of course I realize that all organizational activity and meetings—where we talk to ourselves—couldn't just be suddenly halted for a year. Some organizational business has to be carried on. But, if you recall, I said in the beginning that we might redirect our *major effort and energy* away from ourselves and toward the uncommitted. And I would count on the shock effect of a *moratorium itself* to jar us awake and point us to our larger responsibility.

How can we do this?

I think there are numerous opportunities. Mainly, it would be a matter of becoming more aware of the opportunities, seeking them out, and using initiative and imagination to make the most of them.

(1) Instead of placing our main effort—in speeches, magazine articles, other written materials—before conservation audiences, we could seek out, make an active effort to find, other audiences and outlets. If a speech or article has to be written or made to a

conservation group, then put even more effort in placing it also before a non-committed audience or in a popular magazine.

We in the Forest Service try to do this when the opportunity presents itself, but we could do more of it if we concentrated on this redirection of material. For example, our Chief Ed Cliff made a speech last year called "Forest Patterns—Beauty and Use" to the annual convention of the National Council of State Garden Clubs. This was an explanation, using visuals, of patch-cutting timber in the Northwest. It's a subject that is misunderstood and thus often disapproved of by much of the public. It was adapted to the audience by likening our forest management to large-scale gardening.

I am sure that this speech did us much more good before the leaders of the Garden Clubs than it would have if made to a group of foresters who already have some understanding of the reasons behind patch cutting. Also, just think of what this speech might do for us in the way of better public understanding if it were made to a thousand civic clubs over the country. We did make the presentation into a booklet and distributed it widely.

(2) Let's broaden the conservation dialogue. I would suggest that this could be done by bringing other voices, other disciplines into conservation. It could be done with conservation meetings and conferences, other group meetings, and at universities. Why not expand illustrations and broaden our own insights by bringing the prominent historian, philosopher, thinker, writer, artist, and other lecturers into the conservation dialogue? Often these well-known people already have a deep interest in conservation, and if asked to speak or lecture on it no doubt would further develop their interests.

In the last December issue of that outstanding magazine, *National Wildlife*, Editor John Strohm wrote a remarkable article. It was titled: "The Biggest Question in Conservation—What Can I Do?"

"The question," he wrote, "comes across the editor's desk almost daily, from people of every age, every walk of life, every part of the country. People who realize that there is much to be done, but who aren't quite sure what they can do, or where they can begin."

Then he went on to name some of the "positive, tangible, active things" that can be done—by anyone, anywhere.

Now I certainly find no fault in the appearance of such a useful article in *National Wildlife*. But I wish to make this point: Think of how much more it would have accomplished if it could have gone on to be reprinted in *Reader's Digest*, for example, with the vast audience of some twenty million readers. Or reprints might have been, and might still be, made of it for public distribution at various outlets. Thereby our information efforts are channeled to the larger public,

the yet uncommitted, rather than being limited to the readership of *National Wildlife*.

You may say we don't have the invitation for, say, a ranger to make this speech or a similar one to a local civic club. That's true, we don't. But that's where initiative and imagination comes in. We all know there are ways of maneuvering for invitations to speak, and sometimes it requires no more than merely letting a program chairman know that someone is available and would like to make a speech before his local group.

If plans call for spending time and effort in writing an article for a conservation magazine, why not redirect that same effort into an article for a popular magazine, or a magazine for some group other than conservationists—for plumbers, architects, or a labor union magazine? You may say it is hard to get conservation material into popular magazines. That's true, it often is. But if we try enough some of our efforts will pay off. It's impossible only if we don't try.

For example, Admiral Hyman Rickover, a thinker and speaker who gets attention, is an ardent conservationist. The famous historian Henry Steele Commanger, I am sure could make a fascinating talk on conservation.

A conservation lecture or lecture series could be established at every college and university in this country. If there are conservation groups affluent enough—and I am sure some of them are—it would be highly valuable to endow a conservation chair at a university, or at several universities. And for these lectures, I would suggest speakers whose names and intellectual attainments are such that they would draw the public's attention. In this way we could further help to move conservation out of the hands of the few and put the subject where it belongs, in the hands of everybody.

3. We could recruit, cultivate, and train a group of outstanding conservation speakers who would be available to accept invitations and fill lecture engagements before any meeting or group that was interested in learning more about conservation. This would need to be a highly select group who would possess proven ability to hold an audience and get across a message. Of course the speeches would vary with the speaker and his audience, but in the interest of keeping within the same general direction, all speeches should contain one similar segment; this might well be a uniform, well-thought-out explanation of what is conservation.

(4) We could seek our groups of opinion leaders—executives in industry, commerce, the arts and sciences—and not only get the conservation message before them but enlist them in the cause. For example, I have long felt that a forceful conservation message should

be brought before executives of the news media—newspapers, radio, and television. Often it is not enough to convince the working reporter that you have news of vital concern to the public, because the working reporter is not always free to follow his own interests. We ought to go further to reach and convince the managing editors, the publishers, executives, and owners of news media.

(5) We could cultivate and encourage more free-lance writers to write in the conservation field. I have had some experience in this, with good results. It takes effort, but I know it can be done. Today, there are a number of annual awards, with cash prizes, for outstanding conservation writing. We would do well to keep abreast of these awards and do our part by submitting candidates who have served the cause. Perhaps initiating or encouraging more such awards would be another profitable endeavor.

(6) We should continuously seek ways to get the conservation message into the living room by way of television. This is not easy; it is a highly competitive medium, and often seems to have little time for conservation subjects—unless there is some big controversy involved. But it is such an important mass medium that we can't afford not to keep trying.

Fortunately, the Forest Service has been successful with a TV series. I hope all of you know that each Sunday night about 40 million people, according to the latest ratings, watch the popular *Lassie-Forest Ranger* show on the CBS-TV network. Now in its second year and being filmed in full color, it is among the top ten shows on TV. The producers are pleased with the success that it is enjoying as a result of the new conservation-outdoor format. And certainly the Forest Service believes it is doing an outstanding job in telling the American people more about forestry and natural resource conservation.

Another aspect of television, I feel, may offer conservation a real opportunity. That is, *educational TV*. I say I only have a feeling about this because I've had no experience with it and the Forest Service has not explored it either. I do know that more UHF stations are being established, programming is improving, and now all TV sets sold must be able to pick up the UHF channels. So I think we can assume that this communication medium will grow in importance to the community and gradually increase its viewing audience.

In educational TV, without commercials, the competition for time is not so severe, and there should be opportunities for good, imaginative programs and ideas from the conservation front. The opportunity appears to be there for us to get in on the ground floor and grow with

this still developing medium. At the very least, we should explore the possibilities. And perhaps some of you here have done just that.

I have named six ways in which we who are on the inside might turn our message *outward* instead of continuing to talk to ourselves. I am sure you can think of other ways this might be done.

In any renewed drive, or redirected effort, to introduce conservation to the uncommitted, I feel that it is essential to make every effort to explain repeatedly *what conservation is*. Conservation means different things to different people. To a large number, evidently it means pure preservation.

If we fail to communicate a more or less uniform definition of conservation, there will continue to be confusion and lost motion; and pressures will continue to rise to *preserve* everything in sight and the word *use* will become a dirty word.

I believe most of us here could agree that conservation is the wise use and development of our natural environment for the greatest good of the greatest number in the long run. Wise use (we must also explain) includes, and in most cases is not incompatible with, beauty and preservation.

Certainly in many areas, the wisest or best use is strict preservation—for the esthetic, scenic, or scientific values. Under the larger concept of multiple use, the Forest Service has been dedicated to the principle of preserving for special purposes, during its entire 60-year history. This is attested to by pioneering the concept of wilderness preservation and the setting aside of 14 million acres for that purpose, 9½ million of which formed the beginning of the new National Wilderness Preservation System. It is attested to by the setting aside and protecting numerous wildlife refuges, sanctuaries, for a songbird—the Kirtland's warbler—and for the California condor, and many other areas preserved for their scientific, scenic, historical, or natural wonders. We are actively engaged in the project to mark out and preserve the natural beauty of certain wild rivers. And, as of last year, through Forest Service initiative, the Congress began to mark out rather large sections as National Recreation Areas where recreation will be the dominant use.

So, I believe you must agree that the Forest Service record as a preserver and protector, where preservation is called for, is a sound one. Yet, we are more and more being painted as wreckers of the landscape—because, in certain places, timber is being harvested. Now, if we are in truth devastating irreplaceable and unquestionably needed scenic splendor, we ought to be criticized and opposed. But the time is upon us when the public is going to have to face up to the question of just how much land can we afford to set aside as inviolate,

and just how much is a rapidly expanding population going to need for its more versatile *use* and *re-use*—which of course is not devastation but good conservation.

What we aim at achieving under multiple use is a *balance*, a harmony, between the various uses and demands. In essence it is a compromise between two or more extremist points of view—to achieve the greatest good for the greatest number in the long run. But it has worked and it will continue to work. And what is more basic to our democratic processes than equitable, reasonable compromise?

Earlier I mentioned a “coordinated” drive. I don’t suppose anybody knows exactly how many conservation organizations and groups there are in the United States. The National Wildlife Federation’s current Directory lists 900 organized groups in the resource management and conservation field. But if you count local groups, field offices and affiliates—all of which have their influence—the number will go into the thousands.

Often these groups are going their own separate ways, advocating a narrow segment of conservation, to the neglect of the larger concept.

In any redirected public relations drive, it seems to me there needs to be some unified effort. I am sure there are ways to reach at least the major conservation groups and bring them into some kind of coordinated undertaking. We dissipate our strength when we all travel narrow, different directions. For our purposes, it’s the old story: there is strength in unity, weakness in too much diversity.

Just think what might be the result if a hundred or two hundred conservation organizations were pushing and publicizing the same over-all message, and redirecting it, not to other conservationists but to the uncommitted.

For example, take a slogan: say, “Conservation is Wise Use,” or “Beauty and Conservation are Partners in Natural Resource Wealth.” I am not picking the slogans here; I am merely pointing out what could be done if all or most groups were working in harness, toward the same general goals. Then, under that large umbrella concept, there would be plenty of room for each to work for its specialized interests.

I must assume that in any such coordinated effort, there would have to be some organized direction. Perhaps this indicates some form of trade association—an association of conservation organizations. Or, maybe it calls for an enlarged role to be played by our moderator, Bryant Chaplin and the American Association for Conservation Information.

The planning and management of our natural environment is a central issue of our times; in the final analysis, it is everybody’s

business. All have a stake in it. I say we ought to have the ingenuity to move the subject out of the hands of the few into the hands of the multitude where it belongs, with the resulting interest, help and support which the multitude can bring to it.

With such a redirection of our informational efforts, we can be the catalysts—we can really get behind conservation's *Third Wave* and make of it a *Tidal Wave*—a widespread, powerful movement that will sweep all American people into its path—and at last take us across the threshold of an enlightened age in ecology—where man truly plans and manages the use of his environment to the highest benefit of all.

The skills and capability are in our hands.

The time to do it is now.

The opportunity is here. Shall we grasp it?

#### DISCUSSION

MR. SETH L. MYERS (Sharon *Herald*, Sharon, Pennsylvania): I would like to comment on Mr. Davis' commendation of the present national administration, and I would like to add that in Pennsylvania we have, we believe, the greatest conservation governor we have ever had.

MR. DAVIS: I would recommend your governor very highly for his interest in conservation. I would point out that when the Forest Service dedicated the Pinchot Institute for Conservation Studies at Milford, Governor Scranton was there. He was one of the speakers, and President Kennedy was there as the principal speaker. I say that conservation of natural resources is a non-political situation, and I want to see every governor and every president take a firm, active part in supporting good use and preservation of our resources.

MISS JUANITA MAHAFFEY (Information Program, Federal Pollution Control Administration): I couldn't let this session go by without one female getting on her feet to say a word. Along the line that Clint mentioned, that of talking among ourselves, to ourselves at these various meetings, I couldn't let this go by without pointing out one very useful thing that I think has been accomplished in our water pollution control program, where we are helping in some other groups, and where these groups have been carrying the message very well to a great many people and in a great many places. We have several systems of grants and among them is a system of demonstration grants.

When I came to this program, a little over seven years ago, no one could ever have thought of a demonstration grant in the field of education. I think this thing evolved through our very capable man, Robert Hutchings, who has handled our information program this last few years, and now I am sorry to say has gone from us. But two of the demonstration plans have gone on. One, to the League of Women Voters, and one to the National Association of Counties, and those two groups have organized a series of national seminars throughout the country that are really accomplishing some very good results in water pollution control and in informing their people. For instance, the National Association of Counties, one of our men who was quite competent in this group was appointed by the President to our Advisory Board. He served a term of three years.

He made this point in seeking this demonstration grant, that county officials, as a rule, are elected for a couple of years and there is a tremendous turnover. They are men who, while they are in office, are having to make decisions about things like building sewage treatment plants and other things relative to stream clean up, and maybe then they are gone from office in a very short time, and someone else comes in who knows nothing whatever about this. So this is the way that he

got this thing started in their association, and they put out a very attractive series of booklets, which I think now are bound into one full booklet that is really doing some good.

While I am here, I want to go back to one other thing that was not brought out here. This has to do with the Ohio gentleman's statement in regard to types of material and their attractiveness. I think all of us who are in federal government information programs know that for a great many years there was a definite era when government publications were staid and unattractive and simply black and white things that were turned out in great profusion, but not a great many people took to them because they were just not attractive. And let me say that we are just now really coming out of this thing. Dan Saults, in the Bureau of Land Management has done a tremendous job in elevating the attractiveness of his publications since he has been there.

Even now, in some of our programs, and this is true in our water pollution control program, it is still a real federal operation to get something printed on good paper and four colors, and I will be glad to see the day when all the federal programs are given a little more leeway in their direction in putting out attractive publications.

DR. GILBERT: At a great risk of life and limb, I make this comment.

Mr. Davis referred to the program that we had a few years ago of refuges as being oversold. I would like for him to comment, if he will, concerning the present situation where maybe Smoky Bear, who has done such a tremendous job of selling the Forest Service image, might not, too, be somewhat oversold in certain areas, and perhaps all forest fires are not bad.

MR. DAVIS: Doug, I had that in my speech, but in the editing, I couldn't cover everything. I am glad you brought this up.

My answer is this. If you haven't seen our new motion picture, which was premiered here at the National Wildlife Federation Presidential Luncheon, I want you to see it, because we show in this movie the importance of prescribed burning, using fire as a tool in the hands of professionals to carry out the management of an area for a tiny songbird, the Kirtland Warbler.

We very definitely use, approve of, and recommend the use of fire as a management tool by professionals, but we certainly try to lean over backwards not to give the general public the idea that all you have to do to be a good citizen is go scurrying fire through the woods. Smoky still disapproves of this.

CHAIRMAN SAULTS: I deeply regret the fact that we have to wind this up.

In a discussion yesterday with Clint Davis, Clint made the comment, and I think it is very valid here, that fire in the timber is like the scalpel in the hands of a surgeon. But let's not put the scalpel in the hands of the public and the kiddies.

This has been a fine panel. I'm very happy that I had the honor of introducing its members. It has been better than I even dared to hope. I think we have had a wonderful group up here.

I would like to sum them up, very quickly and very unfairly by trying to be quick. Don Cullimore of the Outdoor Writers told us that the conservation philosophy has been accepted by the public, and it is time for us to move back into leadership again. And we may even be behind them. I don't think he put it that bluntly, but I think it is true.

Roland Clement served as sort of an astringent here. He says we must treat our predictions and our projections with caution, and he talked about something that needed saying, rather badly, an across-the-board reduction in environmental pollution instead of trying to piecemeal it out.

Doyle Kline told us that to communicate we must not only talk; we must listen. Perhaps we should listen before we talk. He had a philosophy of public relations operations, and Tom Osmer followed that with pointing out how you applied this same philosophy in the community, how to make it work on the ground.

Carl Johnson, I think, could best be summed up by saying that he told us that we are wasting a lot of paper, and we are.



Doug Gilbert says that resource managers should or must have public relations training in school and on the job. This is a challenge to the administrators, too, and I particularly picked up his point that we must educate our advisory boards and commissions, also. They make policy. Now this seems so obvious, that I am afraid that a lot of us overlooked it.

And of course, we have just heard Clint Davis, from the Forest Service, who has told us that we now have a public aesthetic sense, and he didn't use that rather horrible word, developing, and instead of talking to each other, get out and talk to this public about the new third wave.

PART III  
CLOSING GENERAL SESSION

# GENERAL SESSION

Wednesday Afternoon—March 16

*Chairman:* M. GRAHAM NETTING  
Director, Carnegie Museum, Pittsburgh

*Vice Chairman:* EDWARD H. GRAHAM<sup>1</sup>  
Senior Associate, The Conservation Foundation,  
Washington, D. C.

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## MEETING URBANIZATION AND RESOURCES PRESSURES

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### REMARKS OF THE CHAIRMAN

M. GRAHAM NETTING

We have a very interesting concluding session this afternoon. Mr. Gutermuth has assembled an outstanding group of speakers. In the entertainment world we call them a "stable," but that might not be appropriate on this occasion.

When I began my career in the museum field some forty-four years ago, both conservationists and museum workers were considered quite queer. However, during intervening years, conservationists have gained great stature and even museum workers are held in somewhat better esteem. But, regrettably, land use still has some of the hanging attitudes of the days when conservationists were thought queer. There are still places where open space is a dirty phrase. There are still people who look at a virgin marsh or swamp as unproductive land that ought to be filled in and built upon as rapidly as possible, while, at the same time, they are worrying about the water supplies of their community.

This afternoon you will find that the comments of this panel will range all the way from urbanization to wide open spaces.

It is very appropriate that we commence the program with a gentleman from Texas, because a certain husband and wife team from

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<sup>1</sup>Dr. Graham was unable to attend the conference because of illness.

that state in the past few years has given great and aggressive leadership in programs for conservation and natural beauty in the United States.

Mr. S. B. Zisman is a Planning Consultant at San Antonio, Texas. He works throughout the United States and abroad.

He is a graduate of M.I.T., having served on the faculty of that institution as well as other institutions. He is also a visiting professor of architecture at the University of Utah.

He was formerly with the National Resources Planning Board and was a consultant to several government agencies. At present he is working on special projects for the Bureau of Land Management and the Department of the Interior.

It is a real pleasure to introduce to you Mr. S. B. Zisman.

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## URBAN OPEN SPACE

S. B. ZISMAN

*Planning Consultant, San Antonio, Texas*

It is now quite clear that we have become an urban nation. For decades, we have been pointing to the urbanization of the country, marking the changes taking place from a rural-oriented to an urban-dominated society. We have cited the changes in population, in the economy, and in the problems that have attended these changes.

It is hardly necessary now to parade statistics, to number the vast majority of the people living in non-rural places, the great growth of the metropolitan areas and the urbanizing of whole regions. Nor is it now revealing to repeat the obvious about the great impact of great advances in science and technology, in transportation and communication, that have led to the shifting of people from countryside to city and back to the countryside.

We have mused over the nature of the urban form, have discussed and cussed the rise and fall of the city center, of suburbia and exurbia, and have come up with some colorful expressions of our feelings in such terms as "slurb," "subtopia," and "sprawl." Gradually we have begun to see the whole, suburbia not merely as an escape, a haven or a garrison away from the city crowd, but as an inevitable form of expansion, as a real part of the pattern. We have come to face urbia altogether.

The awareness of the urban condition shows on all sides. National magazines for mass as well as special audiences run full issues on The City. The books on urban affairs cascade out of the publishing houses. Urban study centers **multiply** in the colleges and universities.

Enormous treasure, both private and public, is being spent on urban growth within the city and out from it.

Reapportionment has shaken the country and the country boys. The new legislator may find it politically proper and profitable to say, "Now, I'm just a city boy, but . . ."

There is a new Presidential Cabinet post, a new Federal Department of Urban Development, taking full rank at least with Agriculture and Interior, and likely by the end of the century to become predominant in the domestic affairs of the country. And the President of the United States in message and means has virtually centered the new Great Society in the urban arena.

This shift from the rural to the urban scene has not altogether changed all our problems. There remains a concern for the land and how we use or misuse our resources. What is happening is a widening and intensification of this concern, a heightening of the problem in an urban context.

This can be marked in three ways: there are problems to face in the very midst of people, not in remote areas; the problems are not only more immediate and intimate, but more complex and pervasive; and they have a somewhat larger and different audience.

Of all, perhaps the most illustrative is that of the intrusion of the superhighway into the urban area. No one is against highways. We need them; all use them; we are proud of them; and we willingly pay for them. Yet throughout the country there are hot controversies, passionate protests, and vigorous, if not violent, campaigns against them. Terms of opprobrium are given them, such as "concrete octopus" or, when they intersect, "a can of worms."

The furor has developed basically on the issue of how to use the land in urbia. One can give an example from San Francisco, or New Orleans, or more recently Philadelphia, or from a hundred other places large and small. Here I would give what I call the classic example of the North Expressway in San Antonio.

The historic City of the Alamo is blessed with an extraordinary park and natural landscape complex virtually in the heart of the City. It is most commonly referred to as Brackenridge Park but is in effect a system of open spaces, an open space backbone for the whole urban area, taking in not only Brackenridge Park itself but the Olmos Flood Basin, college campuses, the zoo, a golf course and the San Antonio River, which has its source in this very area.

Proposed is an expressway to cut through this open space system. As proposed, it curves and winds its way through virtually every element of the system, crossing an Audubon bird sanctuary and Olmos Creek, a tributary in its natural state to be converted into a

concrete ditch; it moves along a picnic ground and recreation area obliterating a Girl Scout Day Camp and a Nature Trail; it stretches across the Olmos Basin and rises to enormous height, roller coaster fashion, to go over Olmos Dam; it severs the campus of Incarnate Word College, forcing the closing of an elementary school; it cuts through the lands of the San Antonio Zoo (although it is promised to provide an underpass where the buffalo roam); it blocks off the half-built public school gymnasium, slides along the rim of the famous Sunken Garden, hovering over in cantilever the edge of the outdoor theater, squeezes itself between this and the municipal school stadium and blocking a major entrance; it slashes through residential areas, shaves a municipal golf course, and then brutally cuts across a wooded portion of the San Antonio River's natural water course, one of the few remaining wilderness touches left within the city.

How many irreplaceable trees of magnificent size and venerable age, including some landmark live oaks, how much spoilage of adjacent area and how much space to be eaten up by interchanges and other highway structures—these are yet to be fully calculated.

It has been observed that in other places, in other cases of expressway controversies, the fight has been centered on the despoliation of a park *or* the disruption of a neighborhood *or* the severing of a campus, *or* the bisecting of a zoo, *or* the loss of treasured trees and landmarks *or* some other single loss—but in the case of the North Expressway, practically all are involved in one great wholesale invasion.

The Brackenridge Park complex serves specific urban needs, not only as a major greenway leading into the central city, it is also in the Olmos Basin, a major flood protection. It accomodates a host of open space needs of a great part of the urban population and its visitors—for one of the major functions of the city is that of visiting—in recreation and sports. It serves as a setting for institutional development and cultural activities. It is a great urban gathering place—Easter Sunday, for one example, yields the great spectacle of tens of thousands of people who come to this open green space for observance and holiday. Almost every square inch is taken up with family gatherings picnicking, meeting and play, many people coming the day or evening before to claim a spot for the holiday. All through the years, this has been the great play area for the military—from recruit to general—of San Antonio's numerous military bases which also provide the major economic base for the city.

This classic case of the North Expressway in San Antonio tragically dramatizes almost all the issues of the open space problem in the urban area: the misunderstanding of the nature and function

of open space as a fundamental urban resource; the vicious competition for urban land, with needed open space within the urban complex almost always the loser; the faulty planning for urban needs that provides for one limited transportation facility unrelated to others at the expense of others and other needs; the view that all public open land is free for any purpose; the imposition of one device or design suitable in one place—in the open countryside—on a place not suitable—the urban situation; and above all, the concept that development in all places and in all cases is of more value than non-development.

The North Expressway has other lessons for the understanding and use of urban resources: The controversy over the expressway was subject to two bond elections—the first defeated, the second power-housed through—leaving deep community divisions, scars and enmities. It has revealed the inadequacy of local government in the larger question of urban open space and the weaknesses of legislation and administration at higher levels to deal with what is in fact a national, not merely a local, problem. It highlights the great issue of our day: where not to build.

For whatever the scale and place, whether of the large regions of the open country, the metropolitan area, the city, the suburb and the neighborhoods, the problem is not so much where to build but where not to build. Within this issue lies the questions of preservation and conservation, the use of limited natural resources of land and landscape, the basic premises of urban planning today, and the nature and function of open space.

It is in the urban area especially today that this great issue can be read most clearly, for open space planning is the key to the creation of the urban form, from the planning of the great urban region, to the control of senseless scatteration of suburbia, to the park and landscape system, to the street and square pattern, to the individual site itself. Much of the present physical planning of urbia is now concerned with open space problems, parking, water supply, the riverfront, flood control, the greenbelt, the new town, air zoning—the street and other corridor open ways—even the expressway. Other great problems such as the pollution of air, water and land are bound up too with open space functions.

The chief lesson to be learned is that open space is a functional land use—open space is not the left-over land, or the vacant land, the unused land or the waste land. It is of an equal order of consideration with any kind of development.

For the future we can, we must take another view of urban open space as a vital, if not controlling, element of the urban form. In the

long perspective, the test will not be whether man can build anywhere, for this we know now he can do. The test will be on how well he can decide where not to build, whether he can understand that open space is in the design and planning sense the "fixed" element, the building areas the "free."

If we can understand, and apply the understanding, that open space as a system, as a function, as a basic resource, is a determinant and control for urban development, if we can meet the issue of where not to build, we can begin to resolve much of the problems of urban ugliness, or suburban stupor, of deadening pollution in the vast urban stretches where most of us live and shall be living.

And if we can find this way in the urban scene, then it may lead us everywhere in the land.

#### DISCUSSION

CHAIRMAN NETTING: Mr. Zisman's talk raises many questions. Now then, who has the first question?

DR. DASMANN (Conservation Foundation): I would like to ask you to expand on your comment about the inadequacy of local government to solve some of these problems.

MR. ZISMAN: We have in this country not only a personal demography but even more importantly, a geographic democracy. We somehow believe that if a city is set up as it happens to be now, it is in full capacity to deal with affairs even if those affairs are beyond the capacity of the city to deal with them or belong in a larger environment.

In respect to the second point at least, our problems of open space can now be dealt with by the city as it exists at the moment. As metropolitan development takes place in the country, then perhaps we shall have a better mechanism for doing it.

Cities, as they are constituted now, and with the kind of government they have now, are subject too much to pressures for development, anywhere and everywhere, whether to increase the tax base, or for other reasons. The usual argument is to have the city go along with some kind of proposal, even if it applies to the misuse of resources in favor of some kind of development.

The whole structure of our cities is not geared to meeting this kind of problem.

One of the reasons, of course, is that the city, by and large, is not its own master. The city is a part of a higher sovereignty. It is a creature of the state and even in such home rule states as in my own State of Texas, where home rule legislation is fairly strong and gives a city a great deal of power through home rule charters, nevertheless, it can apparently do only those things which the State Legislature gives it power to do. This is very limiting because of the nature of state legislatures as they have been up to the present time.

They have been, as you know, rurally oriented, so that, both in the necessities of the moment and in the limitations established by government, they are inadequate to do the job.

I could go on for another three hours and spell out some other points and give many "for instances." I would like to mention one more thing with regard to this case example I have given, of the North Expressway in San Antonio.

The North Expressway really began in the minds of some people in the Chamber of Commerce. They did what was being done everywhere.

It is important to develop more highways and expressways; more Federal funds



are available; and so this particular proposal was gone into without much thinking. However, it got to the point where people, "the establishment" if you will, got excited, and I have heard more than one person say that the Federal Government should take local government off the hook.

Of course, many people think that the Bureau of Public Roads is the government agency involved in this activity. However, there is no such thing as a Bureau of Public Roads—there is the American Society of State Highway Officials which is operating the program. They follow the policy established by the local people. In other words, if the local people desire it, then they just go along with the local desire.

First of all, a system of national highways is not local business—this is the business of the Federal Government. It is very well to say nice words about it but, after all, the Federal Government should be mainly involved here.

Now, we have a general policy to the effect that we do not like highways to go through park lands either, but so long as they follow this present practice that they are following at the local level, then it seems to me that someone will have to work out a national system which will follow national policies and not local pressures.

As I said, I could go on talking a long time in relation to that item but perhaps this might give you a broader basis in connection with my other remarks.

MR. GORDON FREDINE (National Park Service, Washington, D.C.): Perhaps you are aware of the fact that through the negotiations of Secretary Udall of the Department of the Interior, a very substantial area of scenic beauty was served through the mechanism of using scenic easements along the Potomac River. In this particular case, could you comment on whether or not you think city governments or metropolitan governments or even county governments could utilize this technique of preserving some of the natural beauty in the cities?

MR. ZISMAN: There is no question in my mind but what it can and should be done. I have sounded a little bit sour, I presume, and I am a little bit mad about some of these things. However, on the other hand, I don't think we are in a hopeless situation. It is not my nature as a professional planner and worker to be hopeless. I think one always looks ahead and sees other things.

There have developed a great many programs in this country which are very significant. For example, the establishment of the scenic easement principle is extremely important and can be applied quite definitely as the particular program or, in principle, in local programs. This has been tried in a few places. Therefore, my answer to your question is a simple "Yes."

I would also like to add to this that there are a great many more opportunities to apply some of these things. The waterfront program is extremely important. Most of the cities of the country have, in terms of their historic past, turned their backs on this very wonderful piece of urban structure—the waterway. This is a marvelous design and means, if nothing more, than the tying in of development and non-development at the water's edge. This is one of the most marvelous devices that nature has given us to create really great urban forms. Unfortunately in this country we have turned our backs on it over and over again. Fortunately, there have been some places and some examples where we are meeting in cities now along this line. We are engaged in various areas in programs in relation to developing some of these things, of recognizing them. Here again, I think, this will have to be, a federal program.

In conclusion, I would merely like to add that I don't believe we are doing enough fast enough.

CHAIRMAN NETTING: Are there any further questions?

If not, we now come to the matter of rural landscape and, as you know, bulldozers are no respecters of landscape. They can work in the rural areas as destructively as in the urban areas. Many of us are old enough to remember and have been marked by the Depression. One of the positive results of this period was the formation of the Soil Conservation Service, and many of us can remember the

missionaries and pioneers in this area. These people have cooperated with the farmers and landowners of the country in developing new patterns of land use for the American landscape. It was actually a period of the green light for farm lands.

America is much better off today because of the work that was done by these cooperating agencies, both federal and state.

Our next speaker began his career as a newspaperman in Washington, D.C. He was later director of information for the Soil Conservation Service and also research director for the National Grange. He is now chairman of the Steering Committee for the National Watershed Congress, executive secretary of the National Association of Conservation Districts.

He has been long and intimately associated with soil and water conservation and, therefore, I am very pleased to introduce Mr. Gordon K. Zimmerman.

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## MEETING URBANIZATION AND RESOURCE PRESSURES IN RURAL AMERICA

GORDON K. ZIMMERMAN

*Executive Secretary, National Association of Soil and Water Conservation Districts, Washington, D.C.*

One definition of pressure identifies it as a "weight or burden, as of distress." There are a number of weights and burdens, some at least bordering on distress, already bearing on the resources of rural America. All the available evidence indicates they will grow.

In this paper I propose to identify some of the physical pressures already present and in prospect, in terms of countryside resources. I want to comment on some of the steps being taken to meet the pressures, and also mention some additional actions that might be helpful.

### THE PHYSICAL PRESSURES

Today the vast majority of Americans live in urban areas supported by networks of highways, communications facilities, and mechanical transport that have grown up over the last few decades. Agricultural and industrial productivity have made possible the creation of mass consumption patterns in these huge metropolitan areas and have released large shares of time, formerly required for labor, which can now be diverted to recreation and other leisurely pursuits. The development of energy sources has undergone progressive stages of refinement—from coal to oil to nuclear power.

These are remarkable achievements, and they have created important problems. A society of the scope and magnitude of ours requires enormous quantities of natural resources. It consumes food, water, timber, space, and recreational opportunities in huge amounts. It also makes mistakes in its headlong growth. It misuses, wastes, spoils,

pollutes, and spends its resource capital lavishly as it speeds along unexplored avenues of change.

The national appetite for the objects and patterns of life based on resources is growing. On all sides, the demand is for better diets, higher-quality housing, more automobiles and other consumer goods, better educational and cultural opportunities, and more facilities for outdoor recreation.

How capable are America's people and America's resources of meeting the challenge of this vast array of new and frequently competing demands? Resources for the Future, Inc., an independent research group sponsored by the Ford Foundation, recently assessed the nation's requirements and capabilities in a book widely recognized as representative of the best scientific judgments in this field.<sup>1</sup>

In the book the authors asked this question: "Can the United States, over the balance of the twentieth century, count on enough natural resource supplies to sustain a rate of economic growth sufficient to fulfill all these aspirations?"

Their best answer was a qualified yes. "The American people *can* obtain the natural resources and natural resource products they will need between now and the year 2000," they said. "Whether or not they *will* depends on how hard and how well they work at it."

Projections of resource requirements vary with the source and purpose of the estimation, but the trends are clear. Demands on land, water, and related natural resources in the next few decades will surpass anything we have ever known before.

The population explosion with which we are familiar is at the heart of the matter. Between 1940 and 1960, the nation's population grew by 48 million. Two-thirds of the growth in the last decade occurred in the outlying parts of metropolitan areas—much of this in unincorporated places in the countryside.<sup>2</sup> Now our population exceeds 190 million; projections indicate it will reach the neighborhood of 245 million by 1980, and about 330 million in the year 2000.

This poses a double problem. First, these large numbers of people must be fed, clothed, and housed. Second, this must be accomplished with land, water, and space resources that are dwindling because of the very nature and location of the process of urban growth.

Let us consider the matter of food production. As everyone knows, a shortage of land for food production is not a current problem. The situation by 2000, however, is not as clear.

Although predictions in the field cannot be made with certainty, it appears that improvements in technology are being made at such a rate<sup>4</sup> that we can expect to obtain the 120 percent increase in farm production that will be needed by the year 2000—and get it from

about the same cropland acreage we had in 1960. But we will not have the same amount of cropland in 2000 that we had in 1960.

More than a million acres—many of them prime cropland acres—are being diverted to non-farm uses each year.

It must be mentioned that no reckoning is included here for the possibility that even larger increases in food production may be needed in the future—either for growing commitments to other nations as part of a massive program for dealing with the world food crisis, or for the establishment of larger reserves at home as insurance against natural disaster.

The continuing diversion of often-strategic agricultural land to other uses raises a more serious question than the straightforward technological problem of getting a higher yield per-acre from fewer acres in order to meet increasing demands. This is the complex question of *quality and efficiency* in the use of land resources.

Acres vary widely in their capabilities and are not always interchangeable. A truck-crop acre in New Jersey that becomes part of a shopping center cannot be replaced by a wheat acre in western Kansas. Some land is more suitable for producing particular crops and exists in limited quantity. If land that is less suitable must be pushed into production because the best land is lost, the quality of food is likely to decline and the cost increase. The location, climatic environment, fertility, and physical characteristics of land resources should therefore enter into the calculations of future urban growth and development.

From the standpoint of food production, then, the resource problem in the years directly ahead is not one of *space*, but of the availability of the *kinds of land in the right locations* for the efficient and economic production of high-quality foods.

Other demands on land are accelerating even faster than food requirements. Here are some of the predictions of Resources for the Future, Inc., for the year 2000:

Land for homes, schools, and factories—up 215 percent from 1960

Land for transportation—up 125 percent

Land for wildlife refuges—up 133 percent

Land for reservoirs—up 180 percent

Our requirements for timber by the turn of the century could produce further and drastic impacts on land-use and planning. Projections indicate the demand for forest products will double by the end of the century.<sup>6</sup> If this demand were to be met at present yield rates, something like 300 million acres would have to be added to the existing 484 million acres of commercial forest lands.

On another front, our expected population growth will be accom-

panied by an increase in the total demand for fresh water. We now use about 350 billion gallons daily. By 1980, at least 600 billion gallons per day will be needed.<sup>7</sup> The situation ahead suggests that by 2000—

Municipal water use may double

Manufacturing use of water may quadruple

Water withdrawals for irrigation may increase by 50 percent.

As water needs mount, the entire natural resource scene will become more complex. There will be accompanying requirements for watershed protection, flood prevention, navigation, fish and wildlife development, and recreation. Programs will need to be accelerated not only to protect and improve water sources and supplies, but also to prevent damage to high value improvements that are crowding in upon flood plains as the result of a lack of planning or effective zoning.

It is widely evident that water pollution control and water management efforts must be intensified because of the increase in the amounts and kinds of wastes produced in our rapidly growing economy, and by our enlarging population. There is certain to be a growing emphasis on water conservation and on water re-use. Programs will be aimed at cutting water waste of all kinds, wherever they occur.

So far we have been considering pressures which bear on the *quantity* of resources available. In addition, the number of problems concerning the *quality* of resources and resource-use is rising sharply.

The pace and scale of our urban and industrial growth—leading to helter-skelter development—have created new concerns for what have been called the amenity values of our environment. More and more people are expressing a desire to improve the beauty and livability of our surroundings. They will probably be heard, and as they are we will face new decisions about the utilization of space, not only downtown and in the suburbs, but in the countryside. Billboards and junkyards have already come under fire; there will likely be new attention to roadside and riverside beauty, the protection of unique natural vistas, and the reservation of land to be left in its natural state in order to foster an appreciation of a landscape unmodified by man.

All land—even with the spectacular spread of the suburbs and the intercity highways—will not be used. But the economic and esthetic damage caused by scatteration and sprawl is beginning to exert pressures that will force new consideration of orderliness and beauty in resource and community development.

It is now abundantly clear that a given quantity of land, water, and other resources must generally serve more than one purpose at the

same time. Multiple-purpose use is becoming more than an objective of efficient resource management. The growing pressures are making it an ever-present necessity of life.

#### MEETING THE PRESSURES

Given the pressures at hand and in the offing, the nation has not been standing still. Impressive strides have been taken in the direction of ultimate accommodations and more are in the making. Indeed, it is probably fair to say the nation has generated a momentum toward rational development of its natural resources—and toward conservation. It has been building up for the past three decades, but has accelerated sharply in very recent years.

The momentum is deriving its energy not only from increasing public awareness of resource pressures and conservation deficiencies—brought on by water shortages, urban sprawl, floods, and recreational needs—but by the fresh interest of government and the renewed vigor or private conservation organizations. This is not to say that all the necessary governmental tools are now at hand and public apathy toward conservation has been conquered. Of course not. But there has been substantial progress.

Conservation programs originating two and three decades ago with rather limited objectives have been steadily broadened. The soil conservation program is a pertinent example. Originally designed to deal with dust storms, gulying, and erosion on farm lands, it has been broadened to contribute in an important way to water supply, recreation, wildlife, forest, and other goals, including resource planning. It is now operating in suburban and suburban-fringe areas as well as in the rural countryside.

In the aggregate, Federal, State, and local Government budgets for resource development and conservation have been increasing. There is improved coordination of government programs and broader citizen participation. Conservation research and education have been strengthened, both in and out of government. How can we measure the benefits of research by Resources for the Future and the Conservation Foundation—or the educational work of the Boy Scouts, the National Wildlife Federation, the Jaycees, or the American Forestry Association?

To help meet the pressures, Congress has been moving not only with deliberation but with vision. Consider even a partial listing of its more recent acts: It has established a Water Resources Council and provided for nationwide river basin planning; it has accelerated saline water conversion research, authorized the Land and Water Conservation Fund, and established the Public Land Law Review Commission.

It established the National Wilderness System, the Water Pollution Control Administration, and increased both technical and financial assistance in resource planning and action. It has authorized classification of the public lands administered by the Bureau of Land Management and established the Bureau of Outdoor Recreation and the Office of Water Resources Research. The list could go on at considerable length.

At a slower pace, the states have been modernizing their resource legislation, streamlining their resource agencies, and strengthening their capabilities. Resource planning, which brought forth screams of anguish 30 years ago, is now eminently respectable and a lively art.

Is what we are doing good enough? Probably not, but *we are moving*.

#### ADDITIONAL ACTIONS

The lion's share of the resource development job in America still lies ahead—and most of it must be accomplished in what is now the rural countryside. As we move to the task, I want to commend to conservationists three problems, among many, which face us.

First, there is need to recognize more widely that we have managed so far, that about three-fourths of the land of the nation is *privately* owned. It is on this land that we must depend for most of our food and recreation, for a large share of our wood products, and much of our wildlife. The owners of this land are the first custodians of our annual replenishment of water. How they manage their lands affects the quality and supply of water as well as the probability of flooding.

For good and sufficient reasons, many conservationists have been focusing their attention in recent years on the public sector of the resource problem. The time is now at hand, I suggest, to look more closely at the private sector. It is the biggest sector—and the resource work to be done there is not likely to be accomplished by shrugging it off as part of the so-called "farm problem."

Second, there is need to devise ways in which sound ecological principles can be applied more often and more widely. If we are to up-grade our environment, ecology must be converted from an abstract science to a working tool of resource planners. Somehow, a way must be found to make it more intelligible to landowners and the man on the street. It is also entirely possible that ecologists should associate more with economists and with social and political scientists.—and vice-versa.

Third, there is need to examine the extent of the "rights" that go with land and water ownership. The tide of demand for both is running high, and will rise higher. Acquisition is the goal and the

transactions are multiplying. Rarely is conservation a condition of these sales. Resources are being disposed of, and commitments are being made for their use, with little thought for future generations or the public interests involved.

Land is limited. It is fixed in place, fixed in amount, and it must be used where it is. Only the uses and conservation (or lack of it) are ours to dispose. Unless land and water are to become mere commodities in an economic jungle, some way must be found to guide the headlong operation of a land pricing system that not only permits speculation but grants unlimited choice of land use with the down payment.

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#### DISCUSSION

CHAIRMAN NETTING: This is a very thought-provoking paper, and I now open it for questions from the floor.

MR. FRANK GREGG (Conservation Foundation): I was struck by the reference to flood plains and flood plains only and it is one of the things we might try. I thought we might find it useful to note that states are beginning to get actively into flood-plain planning.

At a meeting in Minneapolis last week, a speaker from the State of Iowa told us that the 1965 reapportioned legislature had given the state director authority to engage in a flood plain zoning, including extensive studies, mapping and direct application of state authority, etc.

I also heard a good case history in this connection, in which the local government has set up a couple of zones in a flood plain, in which development is very highly restricted, almost prohibited.

All I wanted to do was ask the speaker for his reaction to this type of thing and suggest the value of the flood plain. I think it is very critical for fish, wildlife, recreation, scenery, open space, water resources, etc. Perhaps the conservation people might wish to look at this at the state level as an opportunity to get something done through political action.

MR. ZIMMERMAN: If I may comment, I would like to say that it isn't effective zoning that establishes these zones of exchange and also disestablishes them after a period of time. I suspect that, while zoning is now being used in this regard, in time other methods will come forth, such as special easements and so on. However, I don't think this is the time for some of these other methods to be offered.

MR. R. G. WINGARD (Pennsylvania State University): I would like to ask Mr. Zimmerman to comment of his experiences in relation to the extent to which natural scientists or natural resource agency people have participated in or contributed to regional, rural or local land use and resource planning programs. Perhaps Mr. Zimmerman would care to comment on this aspect as a professional planner.

MR. ZIMMERMAN: To answer your question, I would say that I am of the opinion



that the largest share of the legitimate planning that is going on in the United States affecting resources is going on in the urban and suburban areas. In fact, very little, until the last recent years, has gone on in relation to the countryside.

As a consequence of a very recent program there are funds and stimuli for doing some countryside planning. Southeastern Wisconsin is notable, for there is some regional planning there. There is generally a lack of discussion between planners and natural resource scientists. I feel that the failure to communicate is a failure we have not yet met and that there is a great need for communication.

MRS. MARIE BOOKINGER (Nature Conservancy): I thought it might be interesting for you to know that last October a special conference was called to deal with problems relating to the conservation of renewable and natural resources of the Western Hemisphere, in connection with which the United States delegation was represented by Secretary Udall and seven other delegates. At that conference there was a recommendation made that member states, before undertaking any colonization or development project, should conduct thorough and appropriate and planned ecologic research to determine the characteristics of the environment and the ecological processes in order to eliminate the destruction of systems and failure with regard to colonization and development projects.

Now, in South America, several governments are accordingly taking some steps. My question is what is happening in the United States to implement this?

MR. ZIMMERMAN: In my own judgment, very little is happening in the United States. We have delivered ourselves of a great many papers and made a great many observations but, on the other hand, we have done very little.

We have a treasured right in the United States that a man who owns a piece of property, generally speaking, unless he creates an extreme public nuisance with it, has the right to do with that land what he wants. Limitations upon the right of private property owners are added very grudgingly in our country. I am mindful, as I guess all of us are, of what is now going on in connection with real estate firms and others who have a mind to speculate on the probable growth of our cities. In other words, in San Antonio and elsewhere, there is money available for speculation. Farm properties and other properties, including the resources they accommodate, are being purchased against the hour when development will take place. Meanwhile this skyrockets land prices, the values of these resources, out of all proportion. Also, resource management and prices of property are related to the kind of construction you can put on them in the way of housing, factories or highways. Therefore, we have not yet accommodated to the problems of which you speak. We have not found a way, on private property, which is the bulk of the property in the United States, to apply sound ecological or environmental principles to the management and disposition of land. I think this is probably the greatest single problem facing us in the country today insofar as resources go.

CHAIRMAN NETTING: We will have to move on. I am sorry we cannot take time for further questions.

As a native Pennsylvanian, I have been very much concerned with strip mining and strip mining restoration. I could show you, within a few miles of this hotel, some beautiful examples of good habitat restoration and, on the other hand, examples of important habitat that was not restored.

Our next speaker is a forester. He graduated from Michigan State University. He was also an associate professor at the University of Georgia. He has been involved with sub-marginal land programs of the United States Department of Agriculture and the Soil Conservation Service from 1936 to 1944 and, since then, has been Director of Conservation for the Mid-west Coal Producers Institute of Terre Haute, Indiana.

I am happy to present to you Mr. L. E. Sawyer.

## HABITAT RESTORATION

L. E. SAWYER

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Surface mining, commonly referred to as strip mining, for the recovery of coal, clay, shale, copper, iron, and many other minerals is the oldest known method of extracting those minerals from the earth. In many instances it is the only economically feasible method for their recovery. Since our industrial economy is built on the utilization of these products, it is a method of mining that will be with us in one form or another as long as reserves of those products sufficiently close to the surface for that method of recovery are available.

This method of mining completely changes the topography of the land. It so alters the surface of the land that it bears little or no resemblance to the original contour. What may have been level to rolling fields or mountainsides supporting cultivated crops or a cover of grass, brush, or trees are turned into a series of more or less parallel ridges or mounds of rock and shale combined with the soil that originally covered them.

The extraction of coal by this method of mining has probably been responsible for the disturbance of a larger acreage than a combination of the several other products. Coal mining has been located closer to the centers of population; the areas that have been mined are larger; consequently, coal has been the whipping boy and has been held up as the horrible example of what strip mining can do. The disturbance caused by most of the other industries has largely been ignored. With this background, perhaps my discussion of the restoration of surface mined areas will be more meaningful and understandable.

In discussing the restoration of habitat, I am going to confine my remarks largely to the Midwest, principally to Indiana, where I have worked on the reclamation of areas disturbed by the surface mining of coal for more than twenty-one years.

Fortunately, most of our Indiana operators were more farsighted than the operators in many of the other states, since their attempts at the restoration of cover on the areas that had been disturbed date back to 1918. That year one of the early operators planted a block of peach, apple and pear trees on a mined area in Clay County, Indiana. No advance preparation was given the area. Because of the rough topography, trees were not accessible for spray equipment. The original peach and apple trees succumbed to disease and insects. Seedling descendants of those trees are still living and bearing fruit. The original Kieffer pears still stand; they bear prolifically.

Between 1918 and 1926 there are no recorded results of any attempts made at reclamation. In the spring of 1926 the Enos Coal Mining Company planted 2,000 cottonwood trees on a mined area in Pike County, Indiana, in cooperation with the agricultural agent of the New York Central Railroad. That same year the members of the Indiana Coal Producers Association, the strip mine organization, agreed among themselves that they would reforest a minimum of five acres each year for every shovel they had in operation. In those days shovels were small. Some of the mines operated six or seven shovels and the acreage they were obligating themselves to plant seemed to them to be very large.

Why reforestation was picked as the type of reclamation is not a matter of record. I am of the opinion that it was probably because several of the companies were headquartered in Indianapolis and may have contacted the Department of Conservation for suggestions. At any rate, Ralph Wilcox was then state forester, and Joseph Kaylor was the assistant state forester. Those two fellows took the job to heart.

In the springs of 1927 and 1928 they planted trees on blocks of mined land from Boonville, almost on the Ohio River, to as far north as Terre Haute. Practically every species they could think of was tried. The degree of success of the planting of some of these species has been a very important guide in our reclamation work.

The program started in 1927 and continued on a voluntary basis until 1941. That year the coal operators, represented by the Secretary of the Indiana Coal Producers Association, met with representatives of the Indiana Farm Bureau and the Indiana Department of Conservation. Together those three groups drafted a bill which was passed by the Indiana General Assembly. That bill became the first industry-sponsored reclamation law to be passed in the United States. The only effect that law had on the reclamation in Indiana was that it required those operators who had done nothing to do what the farsighted ones had been doing since 1927.

Our Indiana law has had two revisions—in 1951 and again in 1963. Those revisions of the law incorporate practices learned over the years of operation under the law that have improved its effectiveness.

Between 1941 and 1951 we found through research financed at Purdue University that some types of material were capable of supporting grasses and legumes. The 1941 Act carried no provision for grading any of the material. The 1951 amendment provided that land to be devoted to the growth of legumes and pasture was to be graded so that it could be traversed with agricultural machinery. The original Act made no provision for access roads which we had found

were essential in our planting operation. The 1951 amendment provided for the construction of such roads at not to exceed quarter-mile intervals.

Between 1951 and 1963 we learned that we had still another type of potential use for the mined areas that were not good enough to grade so that crops could be harvested but which were still too good to be devoted only to the production of trees. When seeded to grasses they made excellent range land. We found that some final cuts which did not naturally form lakes would, if a suitable dam were constructed, form a valuable piece of water area.

The 1963 amendment to our law gives an alternative of three forms of use of the mined areas. Material of a quality to support grasses and legumes, possibly to be returned to cultivation, is graded so that it can be traversed with agricultural machinery. Other material so rocky that it can never be cultivated but which contains sufficient amounts of lime, phosphate, and potash to support grasses and legumes is top-graded for range or pasture. The remainder of the disturbed areas are reforested. Outside of the grading for possible cultivation and the top-grading for pasture or range, no grading is done, except along public roads where it is simply a matter of esthetics. Dams are now required in all final cuts where lakes may be formed, provided the lake will not interfere with underground operations or damage adjoining property.

On our areas to be reforested we do as little grading as possible. Both the results of research by the Central States Forest Experiment Station and our own field plantings have shown conclusively that we get far better survival and growth of trees on ungraded material. That difference is due to a combination of factors, the first of which is compaction. Ungraded overburden is loose and porous. It absorbs water like a sponge and releases it gradually during dry periods. Once that material is compacted by the grading operation, the picture is entirely different. We experience excessive runoff during periods of heavy rain and serious erosion.

The fact that ungraded mined areas absorb and store large quantities of water is substantiated by a study made in the summer and fall of 1964 by Don Corbett for the Water Research Center of Indiana University on the south fork of the Patoka River. The month of October of that year was the most deficient in rainfall in that area since records were begun. Princeton, Indiana recorded only .08 inch of rainfall and the Enos Mine, about 20 miles east of there, recorded only .02 inch from September 30th to November 15.

The area studied contained 26.1 square miles that had been surface mined. During the month of October, that area contributed an

average of 7 cubic feet per second, or 4,524,200 gallons of water per day, to the Patoka River. Each square mile produced an average of 0.27 cubic feet per second, or 173,340 gallons of water per day. All other tributary streams where there had been no mining remained dry during all of September, October, and part of November, except parts of one small watershed. During much of that period, the Patoka River at Winslow, from which the city obtains its water supply, would have been practically dry except for the flow from the mined areas.

Experiments conducted by the Central States Forest Experiment Station show that on graded material the infiltration rate was 0.4 of an inch per hour, while on the ungraded material the infiltration rate was 4 inches per hour. An experiment conducted by the Illinois Agricultural Experiment Station showed an even wider range of infiltration rate. On their graded material the infiltration rate averaged .85 of an inch per hour, while on the ungraded ridges it averaged 5.21 inches.

In plantings made by the Central States Forest Experiment Station on graded and ungraded material in Ohio, Illinois and Kansas, both the survival and growth rate of trees on ungraded material was significantly higher for all species on the ungraded material. In our own field plantings the results have been startling. On the graded material our survival rate has been about 40 percent while on the ungraded material immediately adjacent to the graded area, the survival rate was about 85 percent. The growth rate of our plantings on graded and ungraded materials shows even more variation than the survival rate. Sweet gum at ten years of age on the graded material was five feet in height, while on ungraded material within 100 feet of the graded area, an eleven-year old sweet gum was twenty feet in height. Both jack pine and red oak planted on those same sites showed the same difference in survival and growth as the sweet gum.

Another important effect of the grading is our increase in planting cost. On the ungraded material rocks are readily visible. A planter can pick his place between rocks in which to plant. Following grading rocks are often covered with from one inch to several inches of material. It is not uncommon to see a planter make repeated attempts to find a place in which to plant on a graded area before he succeeds in finding a place between these buried rocks with sufficient fine materials in which to plant. On our graded areas the number of trees planted per man day has been only half as many as were being planted on ungraded material.

The third detrimental effect of grading is the spreading of acid material. Several of the seams of coal are overlain with rock strata or

beds of shale that are high in sulphides. During the mining operation as much of this material as possible is buried. Some of it is often scattered over the surface of the banks in particles ranging from the size of your fist to others that may be extremely large. In planting an ungraded area, these patches of acid material can be voided. When that area is graded, the acid material that is on the surface is spread over a much larger percentage of the area. Other particles of these rocks which had previously been buried are exposed and spread over the surface, leaving an area that is only marginally plantable, if at all.

The Illinois law, passed in 1961 and patterned after the Indiana law, is the only other law in the country that bases the type of reclamation on the quality of the material with which we are dealing and the ability of that material to produce.

The results of the reclamation program in Indiana have been outstanding. This is an excellent example of wholehearted cooperation between state government and industry. The administration of the law is in the hands of the Department of Natural Resources where it is assigned to the Division of Forestry. Technically trained personnel have always been assigned to the administration of that law. The state nursery has given 100 percent cooperation. They have attempted to produce the species of trees needed for our planting program in the sizes most desirable for that work. They have grown quantities of new species for our trials and have assisted us in any way possible. Because of those relationships and the close cooperation of the mining companies, our planting has been highly successful.

Since the beginning of operations, a total of 82,475 acres have been affected by surface mining to June 30, 1964; 62,171 acres have been reforested with 62,209,700 trees; 5,434 acres of ungraded material have been seeded; 1,487 acres have been graded and seeded; a total of 69,092 acres of the total disturbed land area has been manually reclaimed. Of the remaining acreage, 9,476 are in lakes ranging from one acre to two hundred fifty acres. A total of 3,907 acres in the state remain as unreclaimed. That unreclaimed acreage is a natural lag. It is necessary to let some of the disturbed areas lay for a period of years for rock and shale to break down into plantable material or for harmful chemicals to leach out of them. We normally reclaim about 50 percent of our acreage the year after it is mined. Another 25 to 30 percent has to wait up to four or five years. Of the remaining 20 to 25 percent, some of it has had to wait for as long as 10 or 12 years for hard rock to break down or for sulphides to leach out.

Included in the area that we have reclaimed are 5,455 acres of state forest. There are 12,153 acres devoted to other recreational purposes,

private clubs, sportsmen's clubs, hunting, fishing and picnicking areas and lands leased to the state for public use. Over 4,000 acres have passed into private hands in the form of small to medium-sized tracts for homesites, either as week-end fishing properties or as permanent year-round homes.

The initial planting was confined to reforestation with species which we believed would have future economic importance. Final selection has been arrived at through observing the results of early plantings and through the research results of the Central States Forest Experiment Station and Purdue University.

In determining the type of use for which a mined area is to be reclaimed, we have been guided entirely by the type of material in the overburden. The material that is relatively free of rock, high in lime, phosphate, and potash, is graded for the production of forage to be mechanically harvested or for row crops. Other material of a comparable quality chemically, but rocky, is top-graded for pasture. Our reforestation on the remainder of the areas is not a shotgun job. Species planted on any given site are species which have been proven by experience to be adapted to that site.

We now have four basic planting mixtures on which we concentrate: (1) better hardwoods are concentrated on areas with a pH of about 5.4 to 7.0; (2) acid-tolerant hardwoods for non-sandy areas having a pH of 4.0 to 5.4; (3) hard pines for similar low pH but sandy material; (4) fast-growing hardwoods for areas of high pH but with volunteer vegetation too rank for species with slower initial growth to survive. The only pine we have found that shows real promise of future yield in Indiana is white pine. Both shortleaf and loblolly have done well in extreme southern Illinois and western Kentucky.

As a result of these plantings and our seeding program, we have high-quality hardwoods and pine now growing on these mined areas. Tulip poplar over 22 inches in diameter, black walnut over 18 inches, red oak over 16 inches, and white pine over 18 inches are being managed to produce quality material for Indiana's wood-using industry. Poles, posts, pulpwood, and sawlogs of less valuable species are being harvested from these plantations. High quality cattle are being grazed on areas reclaimed for pasture, and hay is being baled from completely graded areas.

Since we feel that we now know what to do with these mined areas insofar as trees or grasses are concerned, we have recently begun to work on the planting of desirable species of food and cover plants to improve the wildlife habitat. Beginning in 1961, we started planting food and cover plants in cooperation with the Plant Materials Section

of the Soil Conservation Service. We knew before then that we had an extremely heavy deer population in our mined areas in Pike and Warrick Counties, Indiana. In fact, the Pittman-Robinson report for the year following Indiana's first deer season called attention to the size and vigor of that herd. It stated that those deer were larger for a given age than the deer of other parts of the state because of the variety and abundance of food available.

Autumn olive has thrived and done well on a variety of sites. Sand cherry, black chokeberry, sericea lespedeza, and Korean barberry all show promise of being valuable additions to our planting program to increase both food and cover. Other species on trial include medium purple willow, tall purple willow, akebia, perennial sweet pea, memorial rose, love grass, tall oat grass, photinia, dauricia lespedeza, switch grass, partridge pea, Amur honeysuckle, crown vetch, trailing raspberry, sawtooth oak, and sand willow. Chinese chestnuts now bear heavy crops of nuts annually. The desirability and performance of this species caused us to include it as a permanent member of our better hardwood mixture. Korean lespedeza invades our mined areas in almost unbelievable profusion.

In 1962, we entered into a cooperative agreement with the Department of Forestry and Conservation at Purdue University and the Central States Forest Experiment Station for wildlife research. One of our member companies made 3,000 acres available to Purdue for that study. A surplus caboose was moved into the area as a headquarters building. A graduate student is assigned full time to the project.

In 1964, a lease was entered into between one of our members and the Indiana Division of Fish and Game on an area of 2,500 acres to be made available to the State for public hunting and fishing. A lease for an adjoining 1,800 acres was entered into by another company. Currently a lease for an adjoining 2,500 acres is under negotiation with a third company.

The lakes in these mined areas are today furnishing some of the best fishing in the State of Indiana. Record-size bluegill and bass are taken from them regularly. With the planting of the proper species and amounts of cover plants, these areas can become some of the best hunting territory in the state for birds and upland game, as well as for deer.

Public recreation is only a part of the recreational use now being made of these properties. In the northern part of the mining territory closer to the concentration of population, the demand for acreage on these man-made lakes for the construction of either summer or permanent homes now exceeds the supply. This land, which 20 years



ago was a drug on the market, is now in such heavy demand for building sites and recreation that the price it is commanding exceeds the price the companies paid for that land at the time it was acquired for the coal.

With the current reclamation program of the Indiana mining industry, the lands that are mined in the future, as well as those which have been mined in the past, will not only be of economic value to local communities but will also enhance the beauty of the Hoosier landscape.

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## ALASKA'S ECONOMIC RAMPART<sup>1</sup>

STEPHEN H. SPURR<sup>2</sup>

*Dean, Horace H. Rackham School of Graduate Studies, The University of Michigan, Ann Arbor*

The proposed Rampart Canyon Dam on the Yukon River, 100 miles northwest of Fairbanks, would create a body of water bigger than Lake Erie. This largest of all man-made reservoirs would take 30 years to fill, but once filled, would produce 34 billion kilowatts of firm annual electric energy. With a capacity two and one-half times greater than that of Grand Coulee, Rampart could provide electricity for six million people. Yet, Alaska has only 253,000 inhabitants, and the dam site is 2,000 miles through another and mountainous country to the nearest part of the mid-continental or "lower 48" United States.

Should it be built? Optimists and public-power enthusiasts can readily present exponential growth forecasts predicting that 50 to 100 years from now Alaska should have millions of inhabitants each using quantities of electricity to keep themselves warm. The sophisticated and professional estimates of the U. S. Bureau of the Census and the National Power Survey do not confirm this; but, then, who could have predicted the world of the twentieth century a hundred years ago in 1866?

The Michigan study group attacked the problem of the economic development of Alaska, not from the standpoint of trying to justify or deny the feasibility of the Rampart Project, but by trying to build up an objective and constructive power demand from the present economic situation in this largest and most undeveloped of our states.

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<sup>1</sup>Based upon the summary report *Rampart Dam and the Economic Development of Alaska*, 62 pp., March, 1966, available from the Horace H. Rackham School of Graduate Studies, The University of Michigan, Ann Arbor, Michigan, 48104.

<sup>2</sup>The author, Professor of Natural Resources at The University of Michigan, directed the Rampart Dam-Alaska Economic Development Project, undertaken by the School of Natural Resources under the sponsorship of the Natural Resources Council of America.

First, the most important problem to solve is that of providing low-cost electric energy to most Alaskans in the near future. More than 60 percent of the people in Alaska live in the Railbelt Area extending from the Kenai Peninsula through Anchorage and the Matanuska Valley to Fairbanks. Most of the growth of the state should occur in this area. Cook Inlet not only bounds the biggest and fastest-growing city in the state, but also encompasses major petroleum and natural gas discoveries.

Twenty years hence, in 1985, estimates derived from U. S. Bureau of the Census, National Power Survey, and U. S. Department of the Interior projections are that Railbelt Area will have nearly 300,000 inhabitants, each using 10,000 kilowatt hours of electric energy annually. This will require a total installed electric generating capacity of 650,000 kilowatts. Rampart, with its projected installed capacity of 5,050,000 would be eight times too big and could not be in full production until about the year 2000.

The immediate electric power needs of the Railbelt could be quickly and relatively inexpensively met through the construction of an extra-high-voltage transmission grid serving the entire area, thus permitting the construction of large and efficient central generating units. Natural gas is in plentiful supply. Electric energy from gas-fired generating plants should be almost immediately available in the Anchorage area at a lower cost than hydroelectric power could be provided from almost any source ten to thirty years in the future.

## II

Second, efforts of Alaskans to attract power-intensive electroprocess industries to the state should be encouraged. Only aluminum uses enough power in a single block to justify a large power development by itself. The best opportunity for attracting the essential aluminum plant, as well as other industries which might well follow, would be provided by that project which would deliver up to one million kilowatts of electric energy at the lowest possible rates to a deep-water harbor open 12 months a year.

The project that best satisfies these requirements is the Yukon-Taiya diversion of the Upper Yukon. A dam at Miles Canyon on the Yukon River above Whitehorse would permit the diversion of the upper Yukon from Lindeman Lake in Canada under Chilkoot Pass to the Taiya River near Skagway, Alaska. Upwards of 1,200,000 kilowatts of very low-cost power can be generated at tidewater. A combined Canadian-American feasibility study of this project would appear warranted and is strongly recommended.

## III

The Railbelt power grid and the Yukon-Taiya project should provide Alaska both with low-cost power for its major population centers and extra-low-cost power to attract electroprocess industries. Several attractive giant hydroelectric sites are available. These however, should not be developed until the market for hydroelectric power is far more evident than it is today in the face of lower alternative costs of natural gas and nuclear energy.

Among these projects to be considered at some time in the future, Rampart would produce the most power and consequently would have the most uncertain markets. It would be an all-or-nothing gamble. Only if all its power is used would the project prove economical. Its effect upon the salmon run of the Yukon and upon the North American waterfowl breeding population would be great. Rampart should not be authorized at this time.

Wood Canyon on the Copper River could well prove to be more desirable than Rampart in terms of actual power costs. It would block a major salmon run but would create a reservoir of high recreational and fisheries value in marked contrast to Rampart Reservoir.

The Devil Canyon or Upper Susitna project is undoubtedly higher than Rampart in unit energy costs, but it would produce a more reasonable amount of power in a short period of time at the right place.

Woodechopper, upstream from Rampart on the Yukon, would appear to be less desirable economically at the present time, but would have much less serious effects than Rampart on salmon and waterfowl. Its power output and location are more suitable for early development.

None of these projects, however, appears to be competitive with natural gas in the Railbelt Area, assuming that the oil companies will sell it at competitive rates; or with the Yukon-Taiya project in Southeast Alaska, assuming that the necessary international cooperation can be achieved. Omens for the proving out of both assumptions are favorable.

## IV

The escape clause in all arguments for a Rampart Canyon Dam or any other large hydroelectric project is that any power not needed locally can be exported profitably to the general North American market.

This market does exist and will continue to increase. The question is simply one of whether the particular project is the cheapest and best source of that particular increment of power.

In these regards, the prospects for Rampart are not particularly good. Transmission 2000 miles across Canada involves engineering and location problems yet to be solved, international agreements yet to be negotiated, and transmission costs in any event that should make Rampart power more expensive on the lower Pacific Coast than nuclear power generated there.

Hydroelectric costs seem bound to rise over the next thirty years. Major reductions in nuclear power costs have occurred in the last two years. The National Power Survey (1964) projects average nuclear generation costs dropping from a current 5 to 6 mills per kwh to 3 to 4 mills by 1980. It would follow that projects such as Yukon-Taiya, which could tap the main U. S. market within the next twenty years, would be much more likely to be competitive than Rampart, whose power would become available only after the turn of the century.

## V

In summary, with first, the distribution of low-cost gas-fueled electric power throughout the Railbelt Area, and second, the development of minimum-cost power in Southeastern Alaska through the Yukon-Taiya project, most Alaskans would have early access to cheap electricity, and a start can be made to attract electroprocess industries to the state. From these beginnings, the Alaskan power net can be spread, and large low-cost hydroelectric projects can be added, as the Alaskan economy requires.

## MITIGATION

Although fiscal provision could be made in enabling legislation to mitigate wildlife and fisheries losses, no practical means have been proposed for replacing the animals and habitats that would be destroyed by Rampart Dam. Consideration was given to improving other duck breeding areas in Alaska to compensate for losses in the impoundment area, but few sites could be found that warranted any improvement, and costs would be astronomical. As regards salmon, construction of artificial spawning channels or hatcheries downstream would be prohibitively costly and of doubtful success. There is no apparent way to assure passage of salmon past the dam and reservoir, either for ascending adults or descending young. Compensation for losses of other animals was not even considered.

## SUMMARY

Construction of Rampart Dam would lead to a catastrophic loss of migratory waterfowl, a substantial reduction in other bird and mammal resources, and a complete cessation of all salmon runs that now pass the dam site.

To quote the Regional Director of the Fish and Wildlife Service (letter of transmittal of the Rampart report): "Nowhere in the history of water development in North America have the fish and wildlife losses anticipated to result from a single project been so overwhelming."

## DISCUSSION

MR. BUD BODDY (Alaska): Mr. Chairman, I don't have any questions but I would like to make a comment.

We would like to compliment the team that has worked on this and which rendered the report that we have heard here today. I think it is very factual. It has been very gratifying to me, and I know it will be to a great many other people in Alaska. I hope that the people in the other states will pay particular attention to the evidence and the facts developed and make it available to those interested. Thank you very much.

MR. EARL ROSE (Iowa Conservation Commission): Usually the Corps of Engineers requires that the losses to fish and game incurred in these projects be equated with the almighty dollar. Do you have a dollar figure calculated for the losses to the fisheries and wildlife that would be incurred here?

DEAN SPURR: I will pass this one on but let me make one comment. Neither the Department of the Interior field report nor the Corps of Engineers report on Rampart Dam have yet been formally completed or released; so neither the Corps nor the Reclamation Service has taken a formal position on Rampart Dam. The Fish and Wildlife Service report which has been released does make an estimate as to what it would cost to partially restore fish and wildlife resources. These have become astronomical figures for saving as much as 15 percent of the salmon.

DR. A. B. COWAN (University of Michigan): I would like to ask if you have any information that we might be able to look toward as to the length of the life of this impoundment if one completed it?

DEAN SPURR: Actually, the reservoir would have an extremely long-life despite the fact that the Yukon carries a heavy silt load in spring and summer floods.

MR. JOHN DEVALAN (New York Times): I have been told privately that the Rampart Canyon Dam appears to have the image of a major federal boondoggle, and I would like to ask if there is any answer to this from either side.

DEAN SPURR: Of course, you are quoting the New York Times. (Laughter)

MR. DEVALAN: I am not quoting the New York Times

DEAN SPURR: There was an editorial in the New York Times that called it a boondoggle.

MR. DEVALAN: I am quoting conservationists with whom I have had some contact.

DEAN SPURR: Well, we made every effort to put together the most competent group of specialists we could find without regard to their political views or views on Rampart Canyon Dam. I did not know what a single one of these people thought when I asked them to join the team. We tried to approach the problem of economic development of Alaska from a constructive sense, as to what was the best thing to do to help Alaskans, and we found that we had some very able people involved here.

I think our report will indicate very clearly that we do not believe that the best economic development of Alaska is satisfied by this very large, very expensive, very long-time and very problematical project, so if you ask what is the best investment for Alaska, it is certainly not Rampart Canyon Dam.

CHAIRMAN NETTING: Are there further questions?

If not, I would like to conclude this program by saying that this report that you have just heard from Dean Spurr and Dr. Leopold sets a pattern for what conservationists should attempt in other controversial issues. It is not enough to be

against something—there must be alternatives presented and carefully considered so that the people can weigh the possibilities and reach some sound judgment based on broad alternatives, well prepared and well documented, *etc.* This report, as an independent study, offers the possibility for you to reach your conclusions on a factual basis.

I would like to thank the members of the panel. I pushed them very hard this afternoon.

I would now like to turn the meeting back to Mr. Gutermuth.

MR. C. R. GUTERMUTH: Thank you, Dr. Netting.

While I want to thank Dr. Netting, I first would like to add a few supplemental remarks to what he has just said with regard to this study.

First of all, I would like to make it very clear to all of you that this study is unique in many ways but the important fact, I think, is that the Natural Resources Council of America, which is made up of most of the larger conservation organizations and scientific societies in this field, has found a way to finance a fair and impartial study of this kind. This is something truly outstanding, significant, and a milestone in the history of conservation.

It was a great delight to me when organizations such as the Boone and Crockett Club, the Conservation Foundation, the Izaak Walton League of America, the National Audubon Society and the Wildlife Society, as well as many others, join together in financing this kind of a study, as Dr. Netting indicated, to give us a fair and impartial appraisal of this proposal because it is quite obvious that this is going to be a long-time battle. We need some facts and figures with which to combat the outlandish statements of benefits being put out by certain people and as to what the ultimate effect of Rampart Dam is going to be. Of course, this effect is something that nobody knows but, on the other hand, this is certainly a step in the right direction and I for one hope that the Natural Resources Council of America as well as other similar organizations will find ways of doing other things of this nature as time goes on.

Now then, getting back to this program itself, not only do we want to thank Dr. Netting for presiding so well here today and keeping this program on schedule, but I also want to take this opportunity to thank him and the Carnegie Museum for giving all of the registrants at this great Conference a copy of "Mammals of Pennsylvania."

Also, in behalf of the members of the Cooperative Wildlife Research Units, I want to thank you and the Museum for your splendid hospitality in the tour through the Museum last Friday. Those of you who have not had an opportunity to go and see the Carnegie Museum should take advantage of that while you are here because I am going to say to you it is one of the finest and most outstanding museums in this country—in fact, in the world. I think your collection of prehistoric mammals is tremendous. (Applause)

## EFFECTS OF THE PROPOSED RAMPART DAM ON WILDLIFE AND FISHERIES

A. STARKER LEOPOLD

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JUSTIN W. LEONARD

*School of Natural Resources, University of Michigan, Ann Arbor*

The proposed Rampart Dam in the Yukon River would inundate an area of riparian lowlands somewhat in excess of 10,500 square miles, which is a bit larger than the state of New Jersey. The impoundment would drown out 400 river miles of the mainstream Yukon, over 12,000 miles of tributary streams, and 36,000 lakes and ponds scattered over the flats. The dam and its impoundment would block the migration of salmon into a third or more of the upper Yukon watershed. Habitat changes of this magnitude clearly have the potentiality of enormous impact on wildlife and fishery resources.

In accordance with provisions of the Fish and Wildlife Conservation Act, the Corps of Engineers asked the U. S. Fish and Wildlife Service to assess the possible effects of the Rampart project on wildlife and fish. On April 28, 1964, after two years of field study, the Fish and Wildlife Service filed its report. The data presented therein form the basis for the appraisal which we offer today. Our own field surveys convince us that the population figures and assessment of possible damages expressed in the Fish and Wildlife Service report are not exaggerated and may in fact be conservative.

In presenting this analysis of the Rampart project, we wish to express our indebtedness to the biologists of the Fish and Wildlife Service who conducted the basic field studies—Gordon Watson, Calvin Lensink, Charles Evans, Robert McVey, and the many others who participated.

### NATURE OF THE YUKON RIVER AND ITS FLOOD PLAN

The Yukon Flats consist of a complex admixture of lakes, ponds and sloughs, coniferous and hardwood timber, willow brush and muskeg, with tundra on some elevated ridges. As viewed from a low-flying airplane, it is quite clear that the intermixing of types is maintained in considerable part by action of the meandering and braided channels of the Yukon River itself and some of its principal tributaries. The Yukon is a restless river, constantly undercutting banks on the outswEEP of meanders and depositing new bars on the inner curves. Ox-bow sloughs are left in the wake of the migrating channels and, in time, these develop marshy borders, favorable for waterfowl, muskrats, and beaver. Newly deposited sandbars soon

develop fresh young stands of willow that constitute excellent winter forage for moose. The willow stands advance slowly through successional stages of aspen or cottonwood to spruce forest, and the sloughs fill gradually with organic matter and the silt of spring floods. But sooner or later transient channels of the river migrate back through the forest, again initiating the processes of succession. It is this dynamic process of self-renewal that maintains such varied and productive wildlife habitat on the Yukon floodplain.

Construction of a major dam such as Rampart would change the whole nature of the river. The impoundment area, of course, would become a great lake with little value for waterfowl and none whatsoever for terrestrial animals. Moreover, the 750 miles of riverbottom from the dam site to the delta would be affected. Construction of the dam would greatly reduce peak waterflows that now pass through the lower reaches of the river in spring. There would still be floods, caused by ice jams, but the periods of high discharge which account for much of the cutting and filling would no longer occur. Likewise, reduction of the silt load by settling in the impoundment would further reduce erosion effects.

In short, Rampart Dam would eliminate the bird and mammal populations now occupying the impoundment area (Yukon Flats) and would adversely affect habitats downstream.

#### EFFECTS OF THE DAM ON WILDLIFE

*Waterfowl.*—Of greatest national importance are the migratory waterfowl that use the Yukon Flats as breeding ground and migrate in autumn across Canada to the continental United States and Mexico. Birds reared on the Flats make their way to all the major flyways, but with a substantial concentration in the Pacific flyway.

The Fish and Wildlife Service census figures indicate that over a half million migratory ducks normally breed on the Yukon Flats. This constitutes approximately 1.6 percent of the breeding duck population in the North American continent. The average fall population of adults and young is estimated to be approximately 1.5 million ducks. Widgeon and lesser scaup are the predominant species on the Yukon Flats, followed by pintails, green-winged teal, scoters, shovelers and canvasback. The 24,000 canvasbacks found to nest on the Flats constitute 9 percent of the continental breeding population of this important species. In addition, some 8,000 Canada geese, 2,000 white-fronted geese and 10,000 sandhill cranes nest within the impoundment area. These populations would be displaced and, for all intents and purposes, lost if Rampart Dam were constructed.



The 6,760 square miles of bottomland along the lower Yukon are similar in nature to the Yukon Flats, but much narrower. A supplemental Fish and Wildlife Service report (1965) on downstream effects of the Rampart project estimates that 228,000 ducks, 2,200 geese, and 2,800 swans nest along the riparian lowland. The total breeding population of waterfowl along the lower river is about half of that found in the Yukon Flats, and the density likewise is about half (in terms of breeding birds per square mile). Cessation of flooding would lead to gradual deterioration of the habitat occupied by this population, with lessening effects on down the channel. The quantitative downstream effects of the dam on waterfowl is conjectural. The highly important goose breeding ground on the Yukon-Kuskokwim delta would probably be little affected, since the fresh-water nesting ponds of the delta are not created or maintained by river floods.

In summary, the major losses of migratory waterfowl that would result from construction of Rampart Dam would be the complete extirpation of 1.5 million ducks and 12,500 geese that migrate annually from the Yukon Flats and ultimately an additional modest (but unmeasured) reduction in the number of birds produced along the river below the dam.

Considering just the loss of ducks produced on the Flats, the effect would be a catastrophe of major proportion in relation to the whole international endeavor to protect the waterfowl resource. Since 1936, the U. S. Fish and Wildlife Service has had an ongoing program of acquiring and restoring marsh habitat for waterfowl, financed by the sale of excise stamps to waterfowl hunters. The long-range program envisions the ultimate restoration of 3.7 million acres of habitat, of which 1.75 million acres will be productive breeding marsh. Rampart Dam would destroy 2.4 million acres of high density breeding habitat and 4.5 million acres of lower density habitat in one stroke. Taking into account the efforts to date of all agencies and groups concerned with waterfowl preservation, the 1.5 million ducks produced on the Flats exceeds the aggregate production on all federal and state refuges, and marshlands restored by Ducks Unlimited and other non-governmental groups.

In short, construction of Rampart Dam would negate thirty years of endeavor in waterfowl preservation in North America.

*Moose.*—Of the terrestrial forms of wildlife occurring on the Yukon Flats, the moose is the most important. Present levels of utilization, about 360 animals per year, are far below the potential yield. In March, 1962, the total moose population on the Flats was estimated at

5000. Since moose habitat tends to improve as a result of forest fires, logging, and other human activities, the Fish and Wildlife Service anticipates a future capacity of 12,500 moose on the proposed impoundment area. While these estimates are probably not as accurate as those for waterfowl, it is clear that a major animal resource would be lost if the dam were to be constructed.

Downstream, stabilization of river flow would preclude the normal processes of plant succession and would limit hardwood browse in the strip along either side of the river, thereby affecting the moose population adversely but to a diminishing extent downstream. The total moose population dependent on the lower riverbottom for winter forage is estimated to be in excess of 10,000 animals, with a density substantially higher than that observed in the Rampart impoundment area. In the absence of the dam this population likewise might be expected to increase in the future.

*Other Wildlife.*—The Yukon Flats provide a major wildlife habitat for many other northern mammals. Black and grizzly bears occur at relatively low densities throughout the impoundment area and surrounding hills. Two caribou herds, the Steese-Fortymile herd on the south side of the Yukon River, and the Porcupine River herd north of the river, occupy hill country around the eastern portion of the Flats and occasionally cross the reservoir site. The Yukon Flats themselves are major producers of muskrats, mink, beavers, river otters, marten, wolverine, weasels, lynx, and red fox. The present harvest of 41,000 pelts per year could be increased to approximately 2,500,000 if adequate markets developed for muskrat and the other fur-bearing animals.

An evaluation of the effects on wildlife of a major habitat change, such as building a dam, is generally limited to species directly utilized by man. In the present case emphasis is placed on the effects of the Rampart impoundment on waterfowl, moose, bears, and fur-bearing mammals. It should be kept in mind, however, that a host of lesser animals—which though of less direct import in human affairs have some rights of their own to existence—would be displaced.

#### EFFECTS OF THE DAM ON FISHERIES

*Salmon.*—The Yukon River supports one of the most northerly major salmon runs of the North American continent. Three species dominate these runs: (1) the chinook or king salmon, (2) the chum or dog salmon, and (3) the coho or silver salmon. A few pink and sockeye salmon enter the lower reaches of the river and spawn in the lower tributaries.

The Yukon River strain of chinook negotiates the longest known anadromous run—nearly 2,000 miles from salt water to spawning grounds. The chum and coho runs traverse almost equally great distances. The fat storage which adapts these fish to such long migratory runs renders them especially choice for human consumption. Despite the superior quality of these salmon, their commercial use has not been great. Subsistence fishing by local inhabitants, however, has been substantial. Average recent catches of salmon from the Yukon are estimated as follows:

Species	Average annual take of salmon		
	Commercial	Subsistence	Approx. yearly total
Chinook	72,785	27,200	100,000
Chum	110,400	595,160	724,000
Coho	18,100		
			<u>824,000</u>

Some of these salmon are produced in tributaries below the Rampart Dam, but others migrate far beyond the dam site to the upper reaches of the Yukon. Construction of the Rampart Dam would completely block salmon runs from access to the upper basin. Even if means could be devised to lift the adult salmon over the 530-foot dam, it is questionable whether the migrants could find their way through the 280-mile impoundment to the tributaries and almost a certainty that the downward migrating fingerlings could not traverse the impoundment and the dam. That portion of the salmon run using the upper reaches of the Yukon must be considered totally lost if the dam is built.

The Fish and Wildlife Service estimates that spawning runs passing the dam site are constituted as follows: 20,000 chinook, 200,000 chum, and 50,000 coho. Elimination of these spawning runs would result in a loss of catch in the subsistence and commercial fisheries of the Yukon River system of an estimated 200,000 to 400,000 salmon annually, or somewhere between 25 and 50 percent.

Such a loss would not be merely an economic one. To the native living along the River, whether Eskimo or Athapascan, the annual fish camp and the drying of salmon in racks for himself and his dogs represent a link with his traditional way of life—a time when he is free of unemployment relief and other "benefits" of white man's civilization. It would be difficult to underestimate the sociological

consequences of eliminating this manifestation of self-respect and independent living.

From the standpoint of science, too, the loss would be great. The Yukon chinook has adapted itself to the longest river run in the world. It is unique and, therefore, irreplaceable.

*Fresh Water Fisheries.*—As regards the resident population of fish that might be expected to develop within the newly created reservoir, parallels may be sought in the fish faunas of Great Slave Lake and Great Bear Lake. The initial population build-up might be expected to develop from species naturally occurring in streams and lakes on the Yukon Flats. The more important of these species are the grayling, inconnu, northern pike, lake trout and whitefish. The Fish and Wildlife Service estimates that a population of large whitefish would develop naturally in the new impoundment in 35 to 50 years from the start of dam construction, and that a population of lake trout would develop after a "much longer period of time."

Presumably these resident fish would ultimately supply a commercial fishery, a subsistence fishery for local residents, and a sports fishery with some recreational potential. However, there would be a long time lag before such populations developed, and, in any event, they would not replace salmon as a subsistence fishery in the upper reaches of the Yukon in Canada.

Downstream the Rampart Dam would produce a clear-water regulated river, extending 36 miles to the mouth of the Tanana, which could presumably be more suitable for sports fishing than at present. Below that junction the river would be increasingly turbid as a result of contributions from the Tanana, Koyokuk, and other tributaries.

All in all, improvements in resident fisheries would be a poor substitute for present salmon runs in terms of commercial and subsistence values.

## RENEWING OUR RESOURCE ENVIRONMENT

### A Critique and Appraisal of the 31st North American Wildlife and Natural Resources Conference

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Upon accepting the invitation to serve as conference summarizer, I did so, knowing well that none of you expect the person in this position to appraise and comment meaningfully on each of the reports presented in the General and Technical sessions. If those of you remaining here had suspected I might try, it is highly probable more seats would have been emptied promptly following this last report by Dean Stephen Spurr and Dr. Leopold. Though truly humbled by this task, I like Helen Nielson's observation about humility, "It is like underwear—essential, but indecent if it shows."

I am impressed by the striking resemblance of this conference theme—"Renewing Our Resource Environment"—with the title of that remarkable report made to President Johnson last November by the Environmental Pollution Panel of his Science Advisory Committee—"Restoring the Quality of our Environment." The latter report consists in a definition and analysis of problems and recommended action. In the development of our conference theme, many of the papers in both the General and Technical sessions not only stated the problems but told what we were doing about them. I heard no one imply, however, that we were doing enough! Dr. Gabrielson made a special point of our shortcomings in the first general session.

As Judge Russell Train, the chairman, pointedly noted, there were two lawyers, one engineer and one biologist to keynote this conference theme. Professor Linsky, the engineer, asked this question, "What good is natural beauty if the air is so loused up that you can't see it?" Thus he explained the thirty minutes assigned to him in contrast to the twenty minutes given to natural beauty! He sketched the history of research and development work to alleviate air pollution—and, surprisingly enough, dated it back to about 1860. He provided definition of pollutants, types of sources, and effects on people and their environments. Our technology is sufficiently advanced to handle most of the problems. People have learned they can have air pollution control by insisting on it. He recommended federal research and demonstration projects to illustrate feasibility; citizen group action to remedy local pollution sources; and stepped up training to fill the supply gap in technically skilled people to provide leadership in meeting the problems on a national scale.

Murray Stein of the Federal Water Pollution Control Administration conveyed a strong sense of optimism for checking water pollution and "reversing the tide." He seemed to base this on the advance in technology which has produced the know-how for 95 percent of the problems, and the willingness of people to get personally involved in the fight against pollution. I suspect that he flavored his presentation to please this conservation-minded audience, to bolster our hopes, to soften our sense of frustration these many years. He cited the new spirit of cooperation from industry in the efforts to abate pollution in the Great Lakes System, New York's one billion 700 million-dollar clean waters program, action by the cities of St. Louis and Kansas City to pay for pollution-control facilities. He had a deeply appreciative audience when he identified the dangerous trap of economic expediency expressed by the assumption that dischargers of waste have an inherent right to use the oxygen assimilative capacity of a stream to absorb their wastes. He said, "I believe that oxygen naturally in the water belongs to fish and their attendant chain of life as nature intended; that wastes put in the water and utilizing this life-giving element usurp this gift of nature for private purposes, and that our goal should be maximum treatment of wastes at the source. Some of us, I sincerely hope, may live long enough to see the day when our national purpose will not be to determine how much we can put in, but to see how much we can keep out of the stream."

He has a real big bear by the tail here, for the immediate cost implications for realizing this ideal are enormous. Though my fingers are crossed, this is a goal to fight for, and we must not only watch, but be actively involved in the battle to achieve it.

Hugo Fisher's paper, read by Walt Shannon, described man's assault on the natural environment of California and asked the question, "What is the carrying capacity of the natural environment to accommodate man?" Here he was talking the language of the wildlife and fisheries biologist and the new breed of ecologists who consider man and his works as an integral part of local and world environment problems. He stressed the need for achieving a harmonious balance between man's need for the utilitarian and the esthetic. There is a limit to the tolerance of the human spirit to too much crowding.

"Certainly we cannot return our cities to the natural environment, and it isn't even desirable that we should. . . . But neither can man be free of the need for open space and beauty, any more than he can be free of his need for civilization. It is in the achievement of a harmonious balance between them that he will find his optimum existence."

Dr. Gabrielson asked this question: "Can our soil, our wildlife, our forests and waters be administered so as to assure continuing contribution to society's material and cultural well-being without destruction of the resource capital itself?" He recognized the importance of what he termed "ballot-box conservation" in producing new programs, new laws and authorities to set the stage for action but warned that "getting them done will be difficult because conservationists both in and out of government are devoting more attention to ballot-box conservation than to the muscle and bone of the resources themselves. . . . Passing a new law or calling for a new program is only part of the conservation battle." His message was replete with embarrassing examples of unresolved problems, of decisions for action which were subservient to short-term expedients. He dramatized the point with the imminent ruination of the Everglades National Park stemming from the diversion of fresh water to alleviate a water shortage. "If something isn't done, and soon, I earnestly suggest that the ruined Everglades Park be dedicated as a monument to the stupidity of letting engineers, land speculators, and other local promoters dictate the use of water in any region." He ranged widely and yet pointedly in developing his theme that, though we must look to the future, we will surely lose it by not wisely and adequately making full use of the tools at hand—today. He said, "My suggestion, in conclusion is that conservationists not look entirely to tomorrow for solution of all the problems in which we are interested. To do so would be to blind ourselves to the many opportunities for getting full horsepower out of the things we have. True conservation progress still is measured in terms of what we get done, not what we hope to do."

In the closing General Session, we have heard four distinguished panelists address themselves to the subject, "Meeting Urbanization and Resource Pressures." S. B. Zisman has sketched in graphic terms the mounting problems of urban planners in meeting conflicts between technological "progress," in terms of expressways, parking facilities, and flood control on the one hand, and the preservation of urban open space and parklands on the other.

Gordon K. Zimmerman gave us a lucid picture of the impact of growing urbanization on the rural scene. He reminded us that more than a million acres of prime croplands are being diverted each year to non-farm uses while our population mounts steadily toward an expected 330 million by the year 2000. He provided a temperately optimistic view of the future with guidelines for needed action.

L. E. Sawyer has provided a description of the far-sighted and public-spirited strip mine reclamation work of the Mid-West Coal

Producers Institute and its affiliated companies. "This land, which 20 years ago was a drug on the market," he stated, "is now in such demand for building sites and recreation that the price it is commanding exceeds the price the companies paid for that land at the time it was acquired for the coal."

The final paper, the report on the Rampart Dam, delivered jointly by Dean Stephen H. Spurr and Dr. A. Starker Leopold, is a historic event. It represents a new and important approach to the solution of conservation problems. Dr. Spurr directed the economic development study of the proposed Rampart Dam Project in Alaska. The study was completed recently by the Michigan School of Natural Resources. It was financed jointly by some 15 national conservation organizations through the Natural Resources Council of America. This report sets a pattern for what conservationists should attempt in other controversial matters. I am afraid that there will have to be many more such objective, privately financed appraisals of large projects if real alternatives of choice are going to be presented to the people.

#### TECHNICAL SESSIONS

Monday afternoon I had the difficult problem of being two places at once. Fortunately the authors of papers in the session on disease, nutrition and control provided abstracts well in advance. This session included a lively panel on pesticides and the environment. Hickey and Dustman are to be commended for selecting authors who had accomplished solid and intensive research and were ready to report. Short's paper on evaluating forages for wild ruminants was significantly complemented by the report of Murphy and Coates on the effects of three different protein levels on the reproduction and growth of white-tailed deer. It is heartening to see steady refinement in understanding some of the obscure factors at work which influence the differing response of animals, as individuals and as populations, to what appear on the surface, quite similar environments. The report by Fay aroused unsavory memories of my own experience with avian botulism. However, I was dealing with Type C (and a Commissioner). He turns up Type E, links birds and fish, and so far as I know, his boss doesn't get into it. However, this discovery has special economic significance, and more needs to be learned of the epidemiology and thereby, eventually, provide some rational explanation of why this form of clostridium botulinum should suddenly have become so evident in the fish of Lake Michigan and in the toxic symptoms of the fish-eating birds. Could this also be but another manifestation of water-quality and lake-bottom changes induced by man in the Great Lakes system?



The Pesticides Panel produced quality reports on chlorinated hydrocarbon residues in California fish and wildlife, a firm indictment of endrin in the Mississippi fish kill, DDT in plankton, mollusks and fish in a 100 square-mile estuary of Florida, and a not too comforting report that our national bird, the bald eagle, was physiologically no more sensitive than most other birds to accumulations of DDT in his tissues. The questions and discussion which followed brought out the complexity of this subject and the dangers of oversimplifying. Much has yet to be learned of the meaning of DDT residues. This panel was attended by at least 300 people and proved the sustained drawing power of this subject.

The session on inland, coastal and marine resources, led by Johnson and George, produced two reports on experimental manipulation of birds. Blankinship's study thus far must be encouraging to the World Wildlife Fund's interest in preserving the white-winged dove's dwindling nesting areas in the lower Rio Grande Valley. Shotgun control of the great-tailed grackle, which feeds on the whitewing's eggs, nearly doubles the whitewings' nesting success. Borden and Hochbaum are making interesting attempts to establish the gadwall as a breeding resident in New England. These efforts at finding ways to preserve a species, sometimes involving modification of the migratory pattern, taking advantage of a species' plasticity, are pointing to challenging opportunities.

The paper by Hawkes of Rhode Island made us feel that the estuaries of that state must be one big dumping ground. He was the epitome of the aroused but frustrated citizen who can be the nucleus for effective political action to preserve a resource. William Leitch of Ducks Unlimited took a look at the factors which go into an inventory of wetlands—and the judgments on their comparative values for waterfowl. Dr. Walford's brief but succinct review of that now famous report to the President, "Restoring The Quality of Our Environment," was appropriate to this conference theme. It was particularly valuable to those of his audience who had not read this report. He was so right when he said that no one could read it without concluding no person is innocent of pollution and each individual must play a role in its reduction and prevention.

Dr. Tarzwell's delivery of the subject "Maintaining Water Quality" was deeply challenging. Since we have not properly maintained our water resources in the past, can we do so in the future? If the answer is yes, there must be a profound change in the public's attitude, with full awareness of the magnitude and seriousness of the problem. Since water will have to be reused, he emphasized the incompleteness of our knowledge of the water quality

requirements for each water use, and the vital necessity of research to fill this gap.

I was glad to see industry represented in this session by Baker who reported on status of the long search for a lead shot substitute. The background on the problem of lead poisoning in waterfowl is long and aggravating. It is also embarrassing, for here we have an example of environmental pollution coming directly from recreational hunting. There was disappointment in the admission that no acceptable substitute for lead shot has been found. We are glad to know that Winchester-Western is continuing its effort, but unless an answer is found soon the condition of "attractive economics" may have to be assigned less weight among the equities considered in arriving at decision.

The Tuesday morning session on forest and range resources featured a panel on wildlife damage control. Before discussing the panel I would like to observe that Smith's analysis of the wildlife and forest problems in the heart of Appalachia was somewhat unique for this conference in that it was a sociological dissection of a community to provide an understanding of how the social, economic and historical background of a people produce a problem. Here is illustrated the value of the sociologist's viewpoint in natural resource management and providing avenues for problem solving.

The panel on "Control of Damaging Animals" had both scope and depth. Dr. Parker, a veterinarian with a keen appreciation of a wildlife biologist, pointed out the close ties between the problems of controlling disease in wildlife populations, and their economic damage. He mentioned the wildlife rabies problem as one example. He invited a closer partnership between the epidemiologist and the biologist as a mutually profitable experience.

Mr. Clyde, representing the National Woolgrower's Association, declared he wanted to know "where we can agree." He wore his prejudices in full view, but genially. He was conciliatory and proffered full cooperation in searching for an equitable solution to differences.

Dr. Cummings reviewed the varied methods of control including possibilities of chemo-sterilants. His was an excellent paper in range of subject and illustrations on a worldwide scope.

Dr. Hall asked questions. The lead one was, "Why is grazing of sheep on public lands allowed to continue?" There were many others, and the implied answers were devastating.

It was fitting for Jack Berryman to conclude the panel by clearly stating the new policy of the Bureau of Sport Fisheries and Wildlife with regard to its responsibilities and programs in this field. He

declared emancipation from narrow focus on the pest species itself, "For it is the total ecological situation which results in a pest problem." He gave top priority to an intensive in-service training program to implement the new policies. Though recognizing there would be continuing controversy, I was glad to note that he exhibited restrained optimism and was very determined.

This mixture of panelists and subjects produced a spicy brew. There were 300 to 400 people in attendance. The effectiveness of the panel technique in focusing interest was demonstrated.

The session on field and farm resources started with Arner's report on the management of utility rights-of-way in Maryland, Alabama and Mississippi. Though he described the mechanism of cooperative effort between the companies and public agencies, and specific objectives for the projects, the results he described were chiefly in terms of costs, and success or lack of it in getting the desired vegetative response. There was no mention of an evaluation attempt in terms of wildlife response. There is a broad interest in this subject, and the potentials for selective wildlife habitat improvement work on utility rights-of-way are great. The value of his paper to this conference could have been improved by including a survey of the involvement of the states and provinces in similar programs. Nevertheless he has sparked me into initiating a survey of the potentials for action in my own state. The dilemma of how to control fox rabies in Tennessee, as reported by Lewis, reminds me of our New York problem which began in the late forties. We are still trying to solve it! Hodgdon reported progress in Maine in negotiating agreements for deer management with large timber companies. This is good business for the companies and good news for the sportsmen. Here again we have an industry with an eye to good public relations as a part of profitable operations and a State Conservation Department providing its skills to achieve objectives in the public interest. Barick reported discouraging experiences with small watershed projects in North Carolina but tempered this by professing to see "hope on the horizon." The demonstrable damage to valuable timber in hardwood swamp drainage tends to draw the timber products industry into common cause with fish and wildlife interests in opposing such drainage. He also credits the State Soil Conservation Service people with a change of heart on this matter. Bob Morgan presented an excellent analysis of the North Dakota Game and Fish Department's experience with the small watershed program, and how they are solving the problems of communications, at last participating in early planning of a project while there is time to incorporate fish and wildlife mitigation measures in it. These are no longer merely "side

issues." I'm certain that many state fish and wildlife administrators will find much of their own experience reflected in these reports, and can profit from them. Morgan, as did Barick, gives due credit to Soil Conservation Service staff in the state for the brighter situation.

McKeon described the experience of New York State in establishing and operating a cooperative hunting area on private lands close to New York City. Though close regulation and control are expensive by some standards, the popularity of use, landowners satisfaction, and the value of accurate records on wildlife harvests from a given area are considered adequately compensatory.

Ed Jaenke's explanation of new opportunities for wildlife management in the cropland adjustment program was a welcome one. What will be the role of state wildlife agencies? How will this effect present programs? How will payment rates for hunting access be determined? These were questions whose answers are vital to the states and local farm leaders who will have the responsibility of administering the program. Not all of the answers were forthcoming, and only time will tell to what extent this new program will be acceptable and useful in solution of wildlife habitat improvement and hunting access problems on private lands. Nevertheless we should take full advantage of the opportunity to test it.

The conservation information and education session contained some items which caught the spirit of this conference. Cullimore is from Missouri; he believes, because he has seen the outdoor writer graduate from a limited audience to general public interest in his product. He noted the interest industry is taking in correcting its image in conservation matters and challenged agency I & E staffs to reorient and capitalize on the awakening of broad public interest in the problems of conserving and restoring quality to the outdoors. Clement warned of the misuse of "predictions" of the imminent extinction of threatened species of wildlife, based on provincial and inadequate knowledge. This opens the well-meaning conservationist to devastating rebuttals by "experts" employed to defend the status quo of special interests whose livelihood depends on exploitation of land or water resources. Kline emphasized the necessity of getting our public relations to the grass roots, "For what we fashion there will become our National Natural Resources Management Policy." Osmer of Michigan plugged for the grass roots approach, too, and described the "Community Conservation Project" as an excellent tool because people were personally involved in doing. Johnson, Erickson and Dambach presented a hardhitting criticism of the quality of conservation education materials flooding the public. I would recommend their report as *must* reading for every I & E agency head or editor.

Gilbert described Colorado State University's Public Relations Training Course for resource managers and the non-research Master's Program in this field.

It remained for Davis of the U.S. Forest Service to describe "Conservation's Third Wave," and he strongly advised redirecting our educational efforts to audiences more generalized in their conservation interests—to take full advantage of the new, broad-gauge, conservation-minded climate of the public.

Of the two sessions this morning, most of my time was spent to catch the drift of the state and local reaction to fielding the outdoor recreation ball. There were problems and there were proposals for solution. Voigt of Wisconsin, Steen of Nebraska, and Gazley of Michigan described them for the state conservation administrator. A strong pitch for the need of county participation was made by Smithee of the National Recreation and Park Association. Gottschalk described in eloquent terms the wildlife benefits which would accrue from this greatly accelerated program through preservation of habitat and providing access. BOR's Edward Crafts concluded this session with a "stockholders" report on status of the Land and Water Conservation Fund, both as to income and commitments in projects by states and other agencies. All anticipated sources of revenue into the Fund with exception of the Use Stamp were up to or exceeding estimates.

Major concern of the states involved finding an adequate source of matching money, shortage of planners—problems in establishing program priorities on limited budgets.

Gottschalk's call for reorienting some of our traditional concepts of fish and wildlife resource management, including maintenance of free public hunting and fishing, was stimulating and challenging. I'm in full agreement.

#### GENERAL COMMENT

The organization of this conference, the scheduling of its general and technical sessions to minimize overlap, and providing all of Tuesday afternoon for the meetings of special-interest groups was well and thoughtfully done. The two panels demonstrated the effectiveness of this technique in focusing speakers, material and audience on a subject. The subject however must be carefully chosen for its timeliness, critical and general interest. The pesticide subject meets all of these characteristics and was very appropriate to the theme of the conference. States west of the Mississippi would appear to have had the most interest in subject material in the damage-control panel. But its drawing power was tremendous. I strongly recommend

to the Program Committee that this panel technique be continued. Although I realize the sponsoring Institute wishes to draw as many and varied interest groups as possible into participation, the Technical Sessions could be improved by cutting down the number of subjects in each session to not exceed five. This would allow more productive audience participation through questions and discussion. It should also reduce the excessive heterogeneity of subjects in each session.

The content of this great forum is symptomatic. There is a growing sense of crisis which in the last few years has blossomed into a bewildering array of federal, state and community policies and programs to halt the degradation of our environment, and waste of our resources—including human resources. The erroneous, artificial habit of thought which separates man and nature is breaking down, is being replaced by an ecological conscience which sees man and the force he exerts as an inseparable part of the whole. There are clear perceptions of his actual and potential catalysmic impact on his aquatic, terrestrial and atmospheric environment which were scarcely dreamed of a few decades ago. Hence this international, national and local concern for his future, the present being bad enough!

Fish and wildlife agencies are caught up in this ferment. What happens to land and water is of great concern to us, for the health and adequacy of these basic resources determines the future of the living world around us—and of man himself. Each of us here must have caught the sense of urgency to action. But action must be orderly to achieve the kind of progress we want. It requires planning. It is already requiring reorientation of our traditional missions. Fishing and hunting are important parts of our responsibilities, but more frequently than ever, our biologists are called upon for advice and active participation in project planning and development which may seem to have little or no relation to hunting.

Changes in organization and staffing are the order of the day.

No longer is the Conservation Fund adequate—nor indeed is it fair for the hunter and fisherman to bear this added cost of expanded missions.

Re-education of our own staff people is often necessary.

Re-examination of program priorities is essential.

Communication and coordination with other resource agencies and local planning and action groups are in constant need of improvement.

If all of this is not done, we lose by default. We must not let this happen.

Let us carry back to our homes and occupations a wider and deeper sense of fellowship, of understanding and reverence for this marvelous gift of God's World, and a deeper devotion to our stewardship.

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## CLOSING REMARKS AND ACKNOWLEDGMENTS

C. R. GUTERMUTH

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

Friends, we come to the close of another very successful Conference. Speaking in behalf of the Wildlife Management Institute, I wish to express our sincere thanks to Dr. Cheatum for that outstanding critique and summarization of the Conference program. Everyone realizes it is a tremendous job, a very arduous task to summarize the program of a large conference of this kind. I think you did an excellent job, and I am sure that your recommendations with regard to the program will be considered seriously by the Program Committee.

Our sincere thanks also go to Robert Smith, who represented The Wildlife Society.

All of you know that most of the conservation organizations and scientific societies joined in formulating the program. The Wildlife Society is a very important cog in this whole thing, in the planning of the program, and our thanks to the Society. However, I wanted especially to express our personal thanks to Bob Smith, because he did a splendid job this year.

We are also grateful to the working press, especially to the newspaper here in Pittsburgh, whose editors and outdoors writers have done an excellent job in reporting, not only this meeting but the previous meetings of the National Wildlife Federation.

I want to thank Dan Poole, and I am sure most of you appreciate the splendid job he has done in preparing papers and having outstanding releases of one kind or another made available.

Also, my thanks to Jim Trefethen. It is a task for him to stay as close as he does to the registration desk and handle the banquet affairs and all of the matters that are necessary here, and we appreciate that very much.

I also wish to thank the Pittsburgh Hilton Hotel. I believe you will agree that they have done a good job. The dinner was excellent, the service was good. Their meals, I believe everyone agrees, have been good.

We also appreciate the help given by the Pittsburgh Convention and Visitors Bureau.

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The registered attendance this year is 1100, which means we must have had 1300 or 1400 people here. The banquet last night was close to a capacity crowd, about 739 people. It isn't the numbers, however, it is the attention and the interest manifested, the way in which the people stay in the meetings that count, and this year, I think all of this has been very good.

Now, if you will permit me my customary practice, I wish to present a couple of patient and enduring persons who merit special recognition. I will ask that they stand, not only for our thanks but for their patience throughout the year while Dr. Gabe and I are doing our work and going through the task of planning this program. Therefore, I would like to have Mrs. Gabrielson and my wife, Bess, please stand.

(Applause)

Next year we are going back to the West Coast. We have made arrangements for the 32nd Conference to be held at the New San Francisco Hilton. The dates will be March 13, 14, and 15. The National Wildlife Federation meetings, I presume, will precede ours in the same way as this year.

Therefore, thanks very much for your cooperation and assistance in helping to make this an outstanding and successful Conference. We hope that all of you can get to the West Coast next year and, happy landings.



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## REGISTERED ATTENDANCE AT THE SYMPOSIUM

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### ALABAMA

George W. Allen, Maurice Baker, F. H. Pete Farrar, W. L. Hilland, James E. Keller, Charles D. Kelley, Claude D. Kelley, Earl F. Kennamer, R. E. Merritt, Raymond D. Moody, H. S. Swinger.

### ALASKA

A. W. "Bud" Boddy, Mrs. A. W. Boddy, James W. Brooks, George V. Burger, Frederick C. Dean, Salvatore De Leonardis, Richard M. Hurd, Frank Jones, Maurice W. W. Kelly, Sig Olson, Don H. Strobe, Gordon W. Watson, Mrs. Gordon W. Watson.

### ARIZONA

Robert D. Curtis, Steve Gallizioli, Larry Powell, Daniel P. Schadle, Lyle K. Sowls, Wendell Swank, Fred J. Weiler, N. A. Bill Winter.

### ARKANSAS

William Allen, Wm. M. Apple, Mrs. W. M. Apple, Nelson Cox, Raymond Farris, D. N. Graves.

### CALIFORNIA

David Brower, Maynard Cummings, Ben Glading, Everett Horn, James O. Keith, A. Starker Leopold, Michael McCloskey, Archie S. Mossman, J. Harold Severaid, W. T. Shannon, Dick Teague, Otto H. Teller, Julius Von Nostitz, Marshall White.

### COLORADO

Art Carhart, Mrs. A. J. Christiansen, A. J. Christiansen, Robert R. Elliott, E. H. Hilliard, Jr., Alfred Etter, C. N. Feast, Chris Furneaux, Ruth Furneaux, Douglas L. Gilbert, Fred A. Glover, A. F. C. Greene, Ralph R. Hill, Mrs. Ralph Hill, E. R. Kalmbach, Charles M. Loveless, Laurence E. Riordan, Dwight R. Smith, Harold W. Steinhoff, C. E. Till, Harry R. Woodward.

### CONNECTICUT

John M. Anderson, Ted Bampton, Philip Barske, A. R. Benson, R. C. Clement, Norman C. Comollo, Charles Dickey, Rudy Frank, A. L. Lamson, M. L. Robinson, Michael J. Stula, W. B. Woodring.

### DELAWARE

Robert L. Graham, Robert E. Jones, Charlie Lesser, Jerry R. Longcore, E. Paucatts, Wilbert Raaley, Norman Wilder.

### DISTRICT OF COLUMBIA

Clark P. Baker, Walter S. Boardman, Stewart M. Brandborg, Maria Buchinger, Dorothy W. Check, Louis Clapper, Henry Clepper, Edward P. Cliff, George Crosette, M. Rupert Cutler, F. Fraser Darling, Raymond F. Dasmann, Stuart P. Davey, Helen Davey, Robert S. Dorney, E. J. Douglas, Philip A. Douglas, W. A. Elkins, Fred Evenden, Adrian C. Fox, Ira N. Gabrielson, Mrs. Ira N. Gabrielson, Frank Gregg, C. R. Gutermuth, Mrs. C. R. Gutermuth, Thomas J. Hardgrove, James R. Harlan, Bob Hines, Fred E. Hornaday, Michael Huboda, Robert F. Hutton, E. A. Jaenke, Thomas L. Kimball, Mrs. Thomas L. Kimball, John V. Krutilla, A. C. Labrie, Russ Leonard, Joe Linduska, Lillian Linduska, J. Don Looper, Burton Lauckhart, Mrs. Rose Leffer, Juanita Mahaffey, M. A. Marston, C. W. McDougall, Karl F. Munson, Russ J. Neugebauer, Franklin L. Orth, Robert G. Pettie, Nancy N. Pratico, Dwight F. Rettie, Dan Sauls, Kenneth J. Smithee, Murray Stein, Charles H. Stoddard, Dick Stroud, Lloyd W. Swift, Lee M. Talbot, Martha Hayne Talbot, Russell E. Train, Major R. H. Wagner, O. L. Willis, W. Harley Webster, Don A. Williams, Lee E. Yeager, Marvin Zeldin, Norman K. Zimmerman.

### FLORIDA

Herb Alley, Helen Alley, Philip A. Butler, I. B. Byrd, Malcolm Davis, Earle Frye, William H. Herndon, Jim Powell, George B. Saunders, Sandy Sprunt, F. Don Southwell, H. L. Stoddard, Sr., H. E. Wallace.

**GEORGIA**

J. David Almond, W. Wilson Baker, Leonard E. Foote, Clyde Greenway, Frank A. Hayes, Rosser Malone, Howard A. Miller, Alex B. Montgomery, Leon Neel, Mike R. Pelton, C. J. Perkins, Howard D. Zeller.

**IDAHO**

Frank Church, Paul D. Dalke, Ernest E. Day, R. J. Holmes, Kenneth E. Hungerford, John Madosn, Glenn Stanger, Rogers William.

**ILLINOIS**

James Baker, William E. Cloe, James Davis, Thomas R. Evans, William J. Francis, H. Mike Hoffman, N. W. Hosley, Blair Joselyn, W. D. Klimstra, Miriam B. Klimstra, Ed Kozicky, James H. Moak, John Piazza, William A. Riaski, Glen Sanderson, Roger J. Siglin, Ralph W. Smith, Mrs. R. W. Smith, John E. Warnock.

**INDIANA**

D. L. Allen, Mrs. D. L. Allen, William B. Barnes, Joseph C. Jankowski, Charles M. Kirkpatrick, John C. Olson, Francis Parks, Mrs. Francis Parks, Robert D. Raisch, Mrs. William Reller, L. E. Sawyer, Vernon Wright.

**IOWA**

Robert Barratt, Arnold O. Haugen, Earl Jarvis, William Kornmam, E. T. Rose, E. B. Speaker, Ries Tuttle, J. R. Dick Woodsworth, Mike F. Zark.

**KANSAS**

George C. Halazon, Brian Hall, George C. Moore, R. J. Robel, Mrs. R. J. Robel.

**KENTUCKY**

Arnold Mitchell, Paul W. Sturm.

**LOUISIANA**

Frank J. Braud, Allan Ensminger, Joe L. Herring, John D. Newsom, Joe Wood.

**MAINE**

Malcolm W. Coulter, John Gill, Kenneth W. Hodgdon, Mrs. Kenneth W. Hodgdon, Howard Mendall, S. D. Schemnitz.

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Frank W. Groves, Jim Yoakum.

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Carll N. Fenderson, Jack F. Kamman, David Olson.

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Clinton P. Anderson, Elliott S. Barker, Mrs. Elliott Barker, William S. Huey, Jeff Ingram, Richard Kerr, Doyle Kline, John E. Wood.

**NEW YORK**

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**NORTH CAROLINA**

Frank B. Barick, F. S. Barkalow, Jr., G. E. Beal, Mrs. G. E. Beal, Don W. Hayne, Clyde Patton, Thomas H. Ripley, E. E. Schwall, Don Strode

**NORTH DAKOTA**

Harrey K. Nelson, Russell W. Stuart.

## OHIO

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## OKLAHOMA

Bill Altman, Wendell Bever, Lt. Gary L. Bullard, Raoul Carlesle, Harold S. Cooksey, Mrs. Harold Cooksey, George H. Harrison, Paul Roeber, Adolph Stebler, Elmer Vieth.

## OREGON

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