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of the
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and Natural Resources Conference**

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*Meeting the Challenges
of Modern Conservation*

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Opening Session.
***Grappling with Delivery of Conservation Programs:
Wrestling with the Devil***

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Wildlife Management Institute
Washington, DC

Cochair

Brent Manning
International Association of Fish and Wildlife Agencies
and Wyoming Game and Fish Department
Cheyenne

A Vision for Conservation for the Next 100 Years

Rollin D. Sparrowe
*Wildlife Management Institute
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Welcome to the 68th North American Wildlife and Natural Resources Conference. It is impossible to ignore recent events that are shaping our country and the world. In these unsettling times, homeland security has become a strong focus. It is fitting to begin this conference by recognizing that a strong natural resource base, managed to balance its use with the needs of people, is as essential as any other precautions we may take. The work we will do over this week's time is part of the foundation of our democracy. We must do our job to maintain that foundation and hope for a sane outcome for the world.

We were last here in North Carolina in 1992, and that conference—the 57th North American—was the first under my leadership at the Wildlife Management Institute. Many of the issues we dealt with then are still relevant. In the opening address, I noted polarization between those who believe in management of natural resources, human needs included, and those who believe in no intervention in the natural world. That conflict still drives all too much of the public dialog about natural resources. One only has to look at the recent, adverse

reaction to forest planning processes on five national forests in the southeastern United States to see evidence of the continuous polarization.

The dilemma of inadequate fish and wildlife conservation funding for the states was highlighted on the plenary session in 1992, with the description of the then new Teaming With Wildlife initiative. That early energy joined with advocates for the land and water conservation fund to form the powerful coalition that almost made it to the finish line with the Conservation and Reinvestment Act (CARA) just two years ago. The need for such funding is greater than ever, given the current poor fiscal status of most of the fifty states. New funding still is necessary to allow local management of all wildlife, to avoid having to resort to the Endangered Species Act listings.

After opposing dedicated funding for state conservation programs, the appropriators in congress promised to fund CARA by appropriations. After two years of some progress, the so-called CARA-lite appropriations approach essentially is dead. So much for the argument against the need for dedicated funding.

Funding for state wildlife grants, a remnant of this appropriations approach, continues at a reduced level. This program remains a highly important opportunity for state wildlife agencies to plan and conduct projects that demonstrate the value of investing in state fish and wildlife funding. The comprehensive plans required of states for eligibility should not be treated as hurdles to overcome to receive funding. They should become important tools to further indicate the value of increasing funding to the states.

This is yet another experience that shows that stable conservation programs at the state level cannot work subject to shifting annual priorities. Also at the 57th Conference, Partners in Flight, an attempt to plan for and execute broad programs for songbirds, was just getting underway. Extensive plans and networks have focused on the needs of many bird species and groups, but central focus has been lacking to implement their work. A decade later, the spectacular success of the North American Waterfowl Management Plan and the North American Wetlands Conservation Act is a base on which a wide array of conservationists hope that an all-bird initiative, can take off successfully. A special session on that topic is on the last day of this conference.

In 1992, we focused strongly on national wildlife refuges and their management, as we still do. There were debates over the role of human activities on refuges, and that led to important developments to shape the future of those

important lands. In 1997, the National Wildlife Refuge Improvement Act firmly established that refuges were to be managed first for wildlife, but also that wildlife-related human uses would have priority as a dividend of good management. That was followed by the Refuge Centennial Act of 1999, with focus on a national celebration of the success of the National Wildlife Refuge System for this year, the 100th year since President Theodore Roosevelt established Pelican Island as the first refuge.

A little more than a week ago I had the pleasure of joining the Secretary of Interior and Director Steve Williams at the celebration at Pelican Island and reflecting on how far we have come with the National Wildlife Refuge System. A lot has been done in the past decade through legislation, its implementation and volunteer efforts to enhance the welfare of refuges. It was astounding to hear that 11 volunteers work on national wildlife refuges for every federal employee. That amazing record of volunteerism has taken another turn with the work of the Cooperative Alliance for Refuge Enhancement.

During the last seven years, with bipartisan response from Congress and direct help from administrations, including the current one, refuge funding for operation and maintenance has increased more than \$250 million. While many had hoped to fix the refuge issue by the centennial, tremendous progress has been made and a foundation has been laid. The true challenge now is to seek a substantial, long-term fix to alleviate the hard work of supporting annual appropriations.

We don't say thanks often enough when we advocate for wildlife programs. Too often we argue whether the glass is half empty or half full. Let there be no mistake; bipartisan support from Congress, dedication to this task by key staff on appropriations committees, and the willingness of the current administration to push the envelope in hard times and receive \$50 million for national wildlife refuges in this tough budget climate is an accomplishment we should be thankful for, and we are.

But, something is still missing for the future of the National Wildlife Refuge System. When I left the Fish and Wildlife Service in 1991, an environmental impact statement to describe the status of refuges and chart a course for the future was being drafted. That document never saw the light of day, but new plans began to be drafted. A major conference, conducted by the Service, resulted in *Fulfilling the Promises*, a positive statement of intent for the refuge system's direction. But, a plan detailed enough to let the public, Congress

and successive administrations know where the refuge system should go still eludes us. We understand that acquisition of lands is not a politically correct objective in these times. But, we still need benchmarks against which to work for the future of the system. We need a plan to put us in a position to focus all of this fine support on providing for the long-term welfare of the refuge system, and many of us welcome a chance to help draft one.

We have an array of distinguished people on this plenary session—people who face huge challenges in resource management and who are very important to fulfilling our objectives for North America’s public and private lands. Consider the challenges faced by Dale Bosworth, Chief of the Forest Service and that agency’s management of 192 million acres of some of the finest landscapes in North America. The controversies over forest management go unabated, and Chief Bosworth often has to deal with a divided public when doing his job. Kathleen Clark, Director of the Bureau of Land Management, is responsible for 270 million acres of public lands, under which we find huge mineral resources important to our country’s economy. Those lands also contain some of the most spectacular landscapes in North America, and fish and wildlife resources as extensive as on our national forests. As Chief of the Natural Resources Conservation Service, Bruce Knight is responsible for the implementation of programs that offer \$18 billion worth of conservation benefits to the American people over the next five or six years. That alone would be enough to keep one awake at night, fretting about how to do the job.

Finally, Trevor Swerdfager, Director General of the Canadian Wildlife Service, is challenged by an immense landscape and many of the same problems we face in the United States, not the least of which is implementing a brand new piece of legislation to protect endangered species.

These administrators and their agencies are vastly important to the business of natural resources management in North America. That is why they are at this podium, ready to talk to us and to participate in the many business meetings associated with this Conference. I recently was startled by a comment from some academics who had observed the plenary session line-up and commented to me, “So, you have a bunch of talking heads up front. I guess that’s important, but what does it get for us?” What these associates failed to grasp, reflected by this comment and attitude, is that once the science is done, and the processes for input and evaluation are completed, these are the people who make important decisions. That is why they and those who were in their shoes before

or those who will be there in the future are very important to us. “What does it get for us?” It gets us a commitment to responsible management of much of this continent’s diverse natural resource wealth. They get from us a commitment to work with them to lay a foundation for the next 100 years.

These administrators—our colleagues in natural resources management—have provided great access to those of us who want to talk about management programs and how to improve them. This administration, like any other, looks for accolades when it does something right, such as the refuge funding example that I mentioned earlier. But, we can’t be rubber stamps, and these administrators—our colleagues—know that. Our role is to support them as much as we can, to do the best job possible, while they are in these important positions. When they go in directions we don’t agree with, we have an equal responsibility to speak up.

Partnership is a concept that receives extensive attention these days. Many of us have active partnerships with the agencies managed by all these individuals, and Canada and the United States have a long-term partnership concerning the welfare of migratory birds and their habitats. At a workshop on implementation of the Farm Bill, about 10 days ago, Bruce Knight, his staff and a large array of partners focused on the need for enlarging partnerships that may chart the course for conservation on private lands for the next 100 years. Delivering conservation programs that are both in the interest of those landowners and the public is a larger, more complex task than many realize.

The opportunity expressed by the 2002 Farm Bill is so immense that it could tax our collective capabilities to use the money effectively unless we get our act together. That was the focus of the workshop. We heard that we need to broaden our working relationships, and embrace nontraditional partners, both for fish and wildlife interests and agriculture. We need to think in terms of conservation outcomes, not program labels. For example, a way to make gains for fisheries is to work on water quality. To be successful, the funding and programs don’t need our names on them, but we have to be involved and work with and through local people.

The Wildlife Management Institute recently did an informal survey of the 50 state wildlife agencies regarding the big opportunity through the Farm Bill to cost-share professional staff positions with NRCS to help provide technical assistance to landowners. We found that eleven states had firm cost-sharing agreements and seven more were in progress. Thirty-two do not seem to have taken advantage of this opportunity. The message this sends is that we wildlifers

need to work to make these personal contacts, establish working relationships and take advantage of an opportunity that would affect more habitat than any foreseeable wildlife budget. The door is open to us, but we have to step through it.

Finally, I would like to commemorate the passing of Dr. Dan Leedy, in January. Dan was a gentleman that I had the pleasure of introducing at a couple of recent North American conferences. For many personal and professional reasons, including that he had been at the first North American in 1936 and had only missed two or three in the entire 68 years of this gathering, Dan was a treasure to all of us. As recently as December, he had hoped to recover and come to this North American. He had a diverse career that spanned seven decades. And, he was an inspiration to us all. Only three years ago, Dan went out with friends for the annual hunt on a farm in Virginia and shot a nice buck. He loved the outdoors as much as he did his science and research work.

The reason this gives us pause is that our profession is aging and we are losing those who brought us where we are today. This is true in state, provincial and federal agencies. We hope that those of you exposed to this continuing dialog and these issues become the leaders of the future, in the tradition of Dan Leedy and the great responsibility he passed along to each of us.

Kathleen Clarke

*U.S. Bureau of Land Management
Washington, DC*

Introduction

Thank you, Rollin, for inviting me to participate in this session. The U.S. Bureau of Land Management (BLM) is pleased to provide continuing support for this North American Wildlife and Natural Resources Conference (North American). This conference is a vital touchstone for our BLM resource professionals to come together with private, state and other federal partners. It is through these partnerships that we develop shared and sustainable solutions to the natural resources issues we face.

Challenges

Our mission in the BLM is to sustain the health, diversity and productivity of the public lands, for the use and enjoyment of present and future generations. These lands contribute to the quality of life of the North American people and to our national interests in many different ways. So, we manage them under the principle of multiple use, providing balanced stewardship that recognizes all of the interests and values associated with the public lands. It is a mission that grows more complex every day. One reason for that is the dramatic change we are seeing across the West.

Since the BLM was created 55 years ago, the population of the West has increased from 17 million to 63 million people. Today 22 million people live within 25 miles of the public lands. Increasing public use and more diverse activities results in more resource conflicts and more litigation. With increased population and urbanization, the wildland-urban interface has become a critical challenge for resource managers, particularly for our wildland fire program. Severe fire seasons year after year, combined with severe drought throughout much of the interior West, are adding further pressure on the health of the land and its resources. In these conditions, native vegetation is further stressed while invasive weeds flourish.

In the BLM, we've had calls for help from others that have required us to take people away from their work on the public lands to respond to

emergencies. We've sent fire crews to Australia to help with their difficult fire season, repaying them for the support they've given us. We've supported the National Aeronautical and Space Administration by dispatching personnel to assist in the search for debris from the Space Shuttle Columbia tragedy. We've detailed law enforcement personnel to assist the U.S. Department of Homeland Security.

At the same time, we are responding to several broader priorities that are critically important to the country. President George W. Bush has outlined a national energy plan that will help to reduce our dependence on unreliable, foreign sources of energy by promoting conservation and encouraging development of renewable energy and traditional resources, such as oil and natural gas. He has made it clear these initiatives will be in balance with the need to protect our environment. The BLM is positioned to help implement a balanced and effective energy plan. And, we need to do that for the country.

Another key challenge for us is promoting sustainable working landscapes. By that, we mean land that is productive for ranching, timber harvesting or other activities that provide food and fiber for the nation, contributing to stronger local economies and to the nation's economy.

These sustainable working landscapes are also healthy, with clean water, strong native plant life and plentiful habitat for a diversity of fish and wildlife. These are some of the challenges we face as we strive to manage the public lands for the public benefit today while fulfilling our promise to future generations by conserving the land and the natural resources found there—delivering conservation.

Opportunities

All of these challenges seem daunting. But, on the other side of the ledger, we have tremendous opportunities. And, looking at these opportunities, I feel very confident about our ability to provide sound management and balanced stewardship of the resources the public has entrusted to our care.

We begin with strong leadership and clear direction from President Bush. He has said: "Good stewardship of the environment is not just a personal responsibility, it is a public value. . . . Our duty is to use the land well, and sometimes not to use it at all. This is our responsibility as citizens, but more than that, it is our calling as stewards of the earth." The President has directed us to develop

policies for managing the public lands and resources based on common sense and common ground.

We have strong leadership and clear direction from U.S. Department of the Interior Secretary Gale Norton. Her policy of the Four Cs directs us to manage the public lands through consultation, cooperation and communication, all in the service of conservation.

We have a skilled and dedicated workforce in the BLM. And, we have partners who believe in our mission and who are eager to work with us to find creative and effective solutions. Following are some examples that we're especially proud of.

The Lesser Prairie Chicken

Through the High Plains Partnership for Species at Risk, the BLM along with a number of federal, state and citizen partners has played a key role in conservation of lesser prairie chickens, an icon species of the North American prairie. At last year's North American, our Roswell New Mexico Field Office received an award from the Wildlife Management Institute for aiding the conservation of the lesser prairie chicken in the sand dune-shinnery oak plant community in eastern New Mexico.

The award cited the work of the Roswell New Mexico Field Office in applying vision and consistent effort to adjust traditional land management practices and coordinated conservation efforts with ranchers and energy companies. The award citation also states that the field office developed grazing and land management strategies that restored vegetative health on grazing allotments, and it implemented season and spatial guidelines to minimize the effects of oil and gas operations.

Bring Back the Natives: Aquatic Resource Conservation

Through the National Fish and Wildlife Foundation's, Bring Back the Natives Program, the BLM has worked closely with partners, including Trout Unlimited, to develop and implement aquatic resource conservation projects throughout the West that have benefitted native fish species, including species and habitats in decline. Trout Unlimited taps the interests and enthusiasm for aquatic resource conservation of local, citizen-based groups, including watershed councils, and leverages local knowledge in designing and implementing on-the-ground habitat conservation projects.

The Plant Conservation Alliance

The BLM, along with nine other federal agencies and 188 cooperators—including a diverse array of local and national groups—has brought people and organizations together to share resources and talents to effectively conserve the nation’s native plants. This spectacular diversity of plant species supports economic prosperity and quality of life in our country and the quality of life for the wildlife species we treasure. The BLM’s Plant Conservation Alliance Partnership supports a Weeds Gone Wild information directory on threats and impacts of invasive weed species.

Existing partnerships and the opportunity for new partnerships are among the very promising opportunities we see before us.

Following are some of the other opportunities available to us.

We have new authorities that give us the flexibility we need to develop solutions based on common sense and common ground. Stewardship Contracting Authority allows the BLM to enter into stewardship contracts to achieve land management goals for the public lands that meet local and rural community needs.

Key elements of this authority that we are investigating include:

- promoting forest health: reducing fire hazards by thinning overstocked forest stands to reduce ladder fuels and increase tree vigor
- restoration of wildlife or fish habitat: removing pinyon-juniper in areas encroaching on grass, shrublands or sagebrush, with by-products supporting bioenergy development
- invasive weed control and native plant establishment: removing salt cedar to increase water flows and reestablish native riparian vegetation.

Changes we are proposing in the livestock grazing program will provide more flexibility for resource managers, ranchers and conservation groups to work in partnership to promote conservation and healthier grazing allotments. Healthy grazing lands provide environmental benefits, such as wildlife and fish habitat, erosion control, water purification and recharge, and nutrient cycling. Ranchers have been and will continue to be important partners in resource conservation.

We have additional funding to help us carry out our work. In fiscal year 2003, we have an additional \$14 million for land use planning, our primary method for community participation in resource management. We have an additional \$5 million for Challenge Cost Share, a program that funds partnerships with private organizations and state and local governments for recreation, cultural resources, and wildlife and habitat projects.

In fiscal year 2004, we're requesting an additional \$5.3 million. We want to increase Challenge Cost Share partnerships by \$2 million. The increased funding will support other projects to improve the health of landscapes and watersheds and to manage, protect and restore important fish and wildlife habitats. These projects include monitoring for Gunnison sage grouse, critical winter habitat for elk and deer, migratory birds and special status species habitats. Additional funding will also support inventory work in abandoned mines for sensitive bats and the development of long-term data and models on ferruginous hawks and mountain plovers.

These are some of the opportunities that lie before us and some of the new tools that are available to us to deliver balanced stewardship of the public lands. And, that means delivering conservation.

A Model: Sage Grouse Conservation Strategy

I want to describe one particular effort that I believe can serve as a model for delivering conservation. Many of you are aware of the significant decline in sage grouse populations over the last 50 years. The decline has been caused by a number of interrelated factors; most of them are linked to the conversion of critical sage grouse habitats that exist throughout an 11-state region. BLM manages an estimated 50 million acres of sage grouse habitat. That means we have a significant opportunity to forestall further declines in sage grouse populations, and we can provide a model for delivering conservation on public lands. If the sage grouse were to be listed as threatened or endangered, under either the federal Endangered Species Act or under state endangered species laws, it would have enormous implications for resource use and management on public lands and private lands throughout the region. Because this is so important, I have instructed my senior leadership and staff to prepare, by September 30, a National Sage Grouse Habitat Conservation Strategy. Our approach will identify risks and threats across the range of the sage grouse and develop national-, regional- and state-level strategies for addressing these risks. We will implement these strategies in concert with state conservation planning efforts that are being prepared by the state wildlife agencies. This endeavor will be science-based, collaborative and adaptive. It will also be sustainable.

In delivering conservation, we need to understand and respect the needs of local citizens who bear the burden of species conservation policy decisions.

Community-based stewardship and citizen based efforts are ultimately more sustainable because, in addition to improving habitats, they engender a spirit of mutual responsibility, respect and, therefore, common stewardship of the public and private land resources.

We know there will continue to be changes on the land. That is inevitable. Some will cause more loss or degradation of sagegrouse habitat: fires, population growth, spread of weeds, energy development and other changes. We also know that we can begin restoring habitat, to slow the loss and, eventually, to reverse the loss through restoration and other measures.

Progress through Partnership

While moving ahead with the Sage Grouse Habitat Conservation Strategy, we continue our efforts to restore habitats for many other species across the West. We know from long experience that success depends on many individuals and organizations working in partnership. In the Northwest, we are restoring habitat for salmon and steelhead trout. We are redesigning roads and culverts to improve migratory fish passage and access to tributary streams on BLM and national forest lands. In the Southwest, we have worked with states and counties to acquire critical habitat for the desert tortoise and southwest willow flycatchers. Across Oregon, Montana and Colorado, we have acquired miles of river corridors that are important for recreational uses as well as for wildlife. Throughout the West, we restore riparian habitats along rivers and streams that are vital for many migrating and resident songbirds and raptors.

The Interagency Riparian Restoration Team we created in 1996 with the U.S. Forest Service, in partnership with the Natural Resources Conservation Service, has been developing local solutions with local partners and stakeholders. It has trained and assisted 10,000 people, and it will expand its work in the coming years.

I am especially proud of the leadership our BLM wildlife and fisheries programs have provided in establishing innovative partnerships with the states and other organizations for conservation purposes.

Our Challenge Cost Share program was pioneered by the BLM's Wildlife and Fisheries Program nearly 20 years ago, and it continues to fund and implement more than 300 cooperative projects each year. At last count, we had completed more than 6,000 projects with a combined value in excess of \$250

million dollars for fish, wildlife and rare plant conservation. And, beyond the monetary value of these projects, their contribution to a healthy diversity of plant and animal life on the landscape, for generations to come, is immeasurable.

Balanced Stewardship and Interdependence

The challenge for all of us who are working to deliver conservation is to strive toward balanced stewardship that recognizes the interdependence of all the natural resources under our care. Amory Lovins of the Rocky Mountain Institute, a think tank for sustainability, illustrates the importance of this principle of interdependence, in the story *The Cats of Borneo*. In the 1950s, the World Health Organization set out to help the Dayak people of Borneo, who were suffering from an outbreak of malaria. Their solution was to kill the mosquitoes that were spreading malaria by spraying dichlorodiphenyl trichloroethane (DDT) over the countryside. The mosquitoes began to die and malaria decreased. The Dayak people thought everything was fine until the roofs of their huts began to fall down on their heads. The DDT had also killed a tiny wasp whose source of food was a thatch-eating caterpillar. The caterpillar population exploded, and it began feeding on the thatched roofs. There were other unintended consequences. The DDT poisoned insects that were then eaten by gecko lizards. Cats ate the lizards and died, producing an explosion in the population of rats and, with it, the threat of typhus and plague. Finally, in an attempt to restore the natural balance of that ecosystem, the World Health Organization contracted with the British Royal Air Force to parachute 14,000 cats into Borneo. The lesson of that story is that we cannot provide effective stewardship of our natural environment by focusing on only one species, one resource or one piece of the landscape at a time. We have to recognize that all these things—our own species included—exist in delicate balance with all others.

Conclusion

In the BLM, we are adopting a more interdisciplinary approach to our mission that recognizes this principle of interdependence. We find a good example of that in our fire program and our fuels management projects. This isn't simply a matter of addressing the dangerous buildup of fuels that increase the risk of catastrophic wildfires. Today we look at potential solutions—such as pesticide

use and prescribed burning—and consider how these tools may impact other resources, including threatened and endangered species or candidate species.

I want to close with one example of a creative partnership that reflects these principles of interdependence and balanced stewardship.

In 2001, we initiated a program with the Royal Botanic Gardens, in Kew in London, to collect seeds of at least 2,000 plant species found on BLM-managed lands. The Royal Botanic Gardens is cleaning, testing and storing these seeds for us, and it is providing us with valuable information needed to successfully reintroduce these species on our nation's public lands. BLM botanists are collecting seeds not only for the Royal Botanic Gardens but also for use in local restoration projects. We are working with local growers to multiply these collections for us, so we'll have the native plants we need to restore vegetation before exotic species—noxious weeds—can gain a foothold. We call this program Seeds of Success. I believe we plant seeds of success whenever we get together with federal and state partners, the tribes, local communities, organizations, and individual citizens.

I hope and trust that we are planting more seeds of success here today. We have a lot of common, fertile ground. As I said in the beginning, our mission in the BLM is one that grows more complex and challenging every day. It is not one we can accomplish alone, nor should we attempt to do so.

Good management of the public lands will not be found in bigger government, but in stronger partnership among agencies and organizations like those represented in this room today, and dedicated citizens like you. Together, we are delivering conservation. I salute you for the support and energy, the creativity and determination you bring to this important cause. And, I thank you for inviting me to be with you today.

Investing in the Future of Wildlife

Bruce I. Knight

Natural Resources Conservation Service

Washington, DC

Thank you, Rollie, and good morning, everyone. It is a pleasure for me to be here today to talk about our nation's growing investment in private lands conservation and what it means to wildlife and other resources on North America's farms and ranches.

Today, I would like to tell you a bit about the investment the Administration is making in conservation, about what the National Resources Conservation Service (NRCS) and its partners need to do to get the most out of this investment and, finally, about how new partnerships and new approaches are needed to put this investment to work on the land.

The organizations and individuals here today already are doing much to conserve and improve wildlife habitat and other natural resources. In the coming years, we will have greater opportunities for conservation of all kinds, thanks to the commitment of resources by the Administration and Congress,

That commitment represents the largest investment in conservation on North America's working lands in Farm Bill history—an increase of \$18.5 billion for conservation over ten years. This investment is so big that it announces our entry into what I call *the next golden age of conservation*. Whether you are a wildlife biologist, a state agency professional, a farmer or a rancher, you will be closer to reaching your conservation goals. And, we will be able to do this important conservation work while maintaining a strong and profitable agriculture industry in this country.

Program Run Down

We have a portfolio of conservation programs for addressing unique local concerns, including wildlife habitat issues and help for farmers and ranchers to implement voluntary solutions for complying with—or even avoid being covered by—provisions of all kinds of environmental regulations. NRCS can provide one-on-one technical assistance for reaching these goals. These conservation programs provide a great deal of flexibility for North America's farmers and ranchers to help them enhance the natural resources on their lands.

Most importantly, the programs are now more heavily focused on working lands conservation. Among other things, the programs can help North American farmers and ranchers meet environmental requirements while maintaining their profitability. That will keep agricultural production in this country, rather than drive it to countries with lower environmental standards. High production under good conservation practices at home is good for our economy and good for the global environment.

The biggest single conservation program administered by NRCS is the Environmental Quality Incentives Program (EQIP). EQIP is projected to have an additional \$5.5 billion over the next six years. This fiscal year, EQIP will have nearly \$700 million.

While EQIP is not primarily a wildlife program, those of you who are interested in wildlife issues should look at EQIP closely to see how it can help you reach your goals. The proposal for EQIP was out for comments from mid-February to mid-March. I hope many of you took that opportunity to make your views known on how EQIP should operate.

EQIP is just one program. Other conservation programs show similar increases. Of great interest to many in this room is the Wildlife Habitat Incentives Program (WHIP), which will have \$360 million over six years. In terms of programs to protect working farmland and ranchland, the renamed Farm and RanchLand Protection Program will have nearly \$600 million over six years; this program keeps land in production, while easing the tax burden on the landowner. The new Grassland Reserve Program will have a quarter of a billion dollars in mandatory spending to enroll up to 2 million acres of grazing land.

In addition, the Wetlands Reserve Program (WRP) has significant increases in its acreage cap. Last fall, we were able to enroll more than 200,000 acres, and we will at least match that number again this year.

The new Conservation Security Program (CSP) will provide payments for producers who have historically practiced good stewardship on their agricultural lands and incentives to do more. We issued the Advanced Notice of Proposed Rule Making last month, and we have extended the comment period through April 3. If you have ideas about how the CSP program should work, we want to hear from you.

The emphasis in our rule making is to keep the rules lean and local. Lean and local is Deputy Secretary Jim Moseley's term for writing rules that are simple and for keeping decision making at the local level. The public comment periods

play an important role in keeping the rules lean and local, so please take the time to comment.

New Approaches to Conservation

Recently, I testified before a U.S. House of Representatives Appropriations Subcommittee on the resources NRCS needs to implement the President's vision for private lands conservation. I stressed that the future of conservation on private lands requires not only a continued commitment of resources but new approaches to getting the job done.

If Congress approves the conservation spending proposed by the President, we will have the resources needed to take private land conservation to a new level. In anticipation of receiving these resources, we are already adjusting our traditional ways of thinking and developing new approaches to get the job done. It is not just NRCS that needs to change its thinking and develop new approaches; it is everyone involved in conservation, including our traditional partners and many new partners.

We need to adjust to the increased emphasis placed on conservation on working lands. We need to adjust to the increased emphasis on decision making at the local level. We need to become more efficient—to streamline the delivery of conservation technology and programs. We need to make conservation programs and conservation decision making more accessible. And, we need to learn to work together in more diverse groups to be more effective.

Let's look at what these five adjustments mean to how conservation will get done in the future.

The first is adjusting to the increased emphasis placed on conservation on working lands. Until now, conservation programs for private lands have focused mainly on taking marginal lands out of production. Now, with major investments in EQIP and the new CSP, we will be able to help many more farmers and ranchers implement conservation practices on working lands.

Increased funding and new programs give landowners and operators new opportunities and more flexibility in reaching their conservation goals. The challenge is for us, from landowners to government agencies to nongovernmental organizations to focus on conservation goals, not on program dollars.

For wildlife groups, it means looking beyond the WHIP. For NRCS and district employees, it means not treating a landowner as an EQIP customer or as

a WRP customer, but it does mean looking at the overall conservation needs and objectives. The national and state priorities for EQIP—by far the largest conservation program administered by NRCS—as well as the tier structure for CSP, will help to focus on conservation goals, rather than on specific programs.

The second is adjusting to the increased emphasis on decision making at the local level. NRCS and the U.S. Department of Agriculture are serious about keeping decision making at the local level. In the states and the districts, local decision making involves state conservationists and district conservationists, working with state technical committees and local working groups. State agencies, tribes, nongovernmental organizations and others need to work with or on these committees and working groups to be sure their interests are included in the decision making process.

The third is becoming more efficient. One way we are becoming more efficient is by making procedural changes that eliminate or reduce red tape. For example, NRCS and the Farm Service Agency (FSA) worked together to eliminate the dual concurrence required under EQIP and the Conservation Reserve Program (CRP). Today, we still consult each other, but NRCS makes EQIP decisions, and FSA makes CRP decisions. The new process provides faster service to the landowner. We are looking for other ways to reduce red tape, and we are writing the new rules for conservation programs to avoid creating new red tape.

Another way of becoming more efficient is to rely more on e-government; some of our customers prefer that option. Last summer, we put our *Field Office Technical Guide* online. This service, called e-FOTG, is available, not just to NRCS employees, but to conservation districts, states and tribes, nongovernmental organizations, landowners and anyone else who has use for the latest technical information.

Those of you in western states are undoubtedly aware that our SNOwpack TELemetry (SNOTEL) System provides snowpack information on line. The U.S. Department of Agriculture's e-forms service allows landowners to submit applications for conservation programs on line. Also, our new TechReg service allows technical service providers to register on line.

We realize that e-government is not for everyone, so we are also working hard to make it easier for our customers and partners to do business with us face-to-face or through the mail.

The fourth is making conservation programs and conservation decision making more accessible. I think we've all done a good job of getting the latest

information on conservation programs into the hands of our traditional customers. But, we need to do a better job of bringing in minorities, women, beginners and limited-resource farmers.

Beyond making every farmer aware of our conservation programs, we are also making our technical and program information more accessible. I mentioned the e-FOTG is a tool for efficient program delivery. But, it is also a tool for accessibility. In the old days, landowners and partners alike had to go to the U.S. Department of Agriculture Service Center during office hours to look at practice standards and other technical information. Now, that information is a mouse click away.

Our TechReg system is already providing an efficient way for technical service providers to apply for certification. But, it will also be a tool for accessibility. Landowners won't have to come to a service center to look at a list of technical service providers. Instead, they will be able to find a provider on-line.

We are also asking every state to post its ranking criteria for EQIP on the Web before making decisions on which contracts to award. Having access to the ranking criteria will help landowners structure their applications to directly address the criteria and to avoid the wasted effort of preparing applications that will clearly score low on the criteria.

The last new approach I want to mention today is working in more diverse groups to be more effective. North America's investment in conservation over the next ten years is monumental. There is simply too much work for NRCS and our traditional partners—the conservation districts, the resource conservation and development councils, and the states—to get the job done. We need many other groups to take an active role in making conservation happen. Those groups include many of you here today.

One way we are bringing more participants into the conservation effort is through the Technical Service Provider Process. Essentially, we are creating an entirely new industry of conservation providers in the private sector, state and tribal governments, universities, and professional associations. In fact, later today, I will be signing a memorandum of understanding with The Wildlife Society, making their certified wildlife biologists eligible to be technical service providers.

Some of you who are here today work with organizations that have been involved in developing the Technical Service Provider Process and that will have employees or members who will be technical service providers. Thank you for your participation and for your comments on the interim final rule.

Technical service providers will play an important role in planning and implementing conservation on private lands, and NRCS is committed to making the system work and work well.

One of our guiding principles was to open technical service provider certification to the widest possible range of potential providers. We are also reaching out to make sure the technical service provider community reflects the diversity of North America's agricultural community.

Another way we are bringing more participants into the conservation process is through meetings such as this.

Although the Administration is making an unprecedented investment in conservation on private lands, we need to do more. Last summer, we approved contracts totaling nearly \$700 million for conservation on private lands. We were able to award contracts for thousands of existing applications in several programs.

At the same time, we received thousands of additional applications. Today, we again have a backlog in most programs. EQIP alone now has a backlog of \$1.4 billion nationwide. WRP has 2,800 pending applications, amounting to 475,000 acres. The Farmland Protection Program has more than \$100 million in pending offers for easements.

If we are to help all landowners reach their conservation goals, we will need more resources than the federal government can provide. We will need to combine the resources of the federal government, state agencies, tribes, conservation, wildlife and environmental organizations, foundations, corporations, and others in innovative ways.

To bring all these resources into play, we will need to broaden the conservation partnership to ensure every voice is heard. I hope this meeting will produce some new partners for conservation on private lands.

Conclusion

To summarize, let me say that we have had ten months to celebrate passage of the new Farm Bill and the birth of the new golden age of conservation. The Administration has requested the resources we need to allow us to work with new and existing partners and to have the flexibility to take on new projects. The more partners we have, the more conservation we can do. And, that should be good for wildlife and other resources.

I look forward to working with all of you to make the next golden age of conservation a reality. Thank you.

Session One.

The National Wildlife Refuge System: A Century of Conservation

Chair

Jim Kurth

U.S. Fish and Wildlife Service
Arlington, Virginia

Cochair

Evan Hirsche

National Wildlife Refuge Association
Washington, DC

Celebrating a Century of Conservation

Steven A. Williams

*U. S. Fish and Wildlife Service
Washington, DC*

Imagine North America at the dawn of the 20th century. The United States was emerging as a world power. William McKinley was beginning his second term as President, and his new Vice President, Rough Rider Theodore Roosevelt was a popular figure from the Spanish-American War.

North America, in 1900, had a population of 76 million. There were only 8,000 automobiles, 10 miles of paved roads and 96 auto deaths that year. The Wright brothers' historic flight at Kitty Hawk was still three years away.

Assassinated by an anarchist bullet in 1901 President McKinley would not complete his second term. Just as a new era of conservation consciousness was beginning to unfold in the United States, a new President epitomized the growing recognition of the importance of protecting North America's natural bounty. President Theodore Roosevelt was an adventurous outdoorsman with a profound appreciation of the deeply rooted North American traditions of hunting, fishing and exploration of the wonders of nature. He had the foresight to

recognize that unchecked exploitation of North America's natural resources would threaten both the nation's future and its heritage.

Roosevelt also heard the voices of citizens with a growing advocacy for the conservation of wild North America. One such citizen, a boat builder was an orange grower living on Florida's east coast, a German immigrant named Paul Kroegel. Alarmed by the indiscriminate slaughter of the wild birds at tiny Pelican Island in Florida's Indian River, Kroegel took it upon himself to protect the island from market hunters. He showed as many of the area's visitors as possible the plight of the birds there, hoping to influence others to advocate for their protection. Eventually, he met prominent scientists and researchers with connections to the President; these people urged Roosevelt to protect these birds and the island where they had nested for ages. On March 14, 1903, Roosevelt established the first federally-protected wildlife refuge by executive order, setting aside five-acre Pelican Island as a preserve and breeding ground for native birds.

Early Visionaries

There would be no Pelican Island National Wildlife Refuge (Pelican Island) today, indeed no National Wildlife Refuge System (Refuge System), if it were not for the tireless advocacy of a single citizen, Paul Kroegel, and a President who had the conviction and foresight to spur our uniquely North American mindset about wildlife and habitat protection. Paul Kroegel could not have been successful in continuing to protect Pelican Island without the help of the National Audubon Society. We are not only celebrating the anniversary of the Refuge System, but the anniversary of our first refuge partnership.

Roosevelt went on to establish 53 refuges, from Key West's mangrove islands and sand flats to Flattery Rocks along the Washington coast, where 150,000 pelagic birds nest, and migrating birds sometimes swell the population to over one million.

He also established our nation's first waterfowl refuge, Lower Klamath, in 1908. This 46,000-acre refuge is home to more than just a sky full of waterfowl. Avocets (*Recurvirostra americana*), white pelicans (*Pelecanus erythrorhynchos*) and black-necked stilts (*Himantopus mexicanus*) are part of the myriad birdlife that thrills refuge visitors today.

Spurred by the organization that he cofounded, the Boone and Crockett Club, Roosevelt also ensured the early Refuge System provided habitat and

management for big game populations that had been depleted on public lands. From an estimated 60 million bison (*Bison bison*), no more than 1 thousand could be found on the Great Plains in 1900. Elk (*Cervis canadensis*) populations had been greatly depleted. Wichita Mountains, established as a forest reserve in 1901, became a refuge in 1905. Work began there to restore bison, elk and turkey (*Meleagris gallopavo*). The National Bison Range followed in 1909, the National Elk Refuge in 1914. Sulleys Hill, established as a national park in 1904, was added to the Refuge System in 1931. All four refuges worked to restore elk and bison. I know Sulleys Hill well; I did my Master's degree research there.

The history of the National Elk Refuge is a great story of the type of partnerships required to protect wildlife and its habitat. The first official suggestion for a permanent elk refuge in Jackson Hole was made in 1906 by the Wyoming State Game Warden, D. C. Nowlin, who, following his retirement from that post, became the first manager of the National Elk Refuge.

By 1916, 2,760 acres had been acquired for the National Elk Refuge. It took another 9 years to add 1,760 acres donated by the Izaak Walton League of America. Today, nearly 90 years later, the refuge spans nearly 25,000 acres, the last remaining elk winter range in Jackson Hole.

The efforts of the Izaak Walton League were not confined to the National Elk Refuge. They began in 1922 when fifty-four hunters concerned about pollution and declines in wildlife met, formed the league and elected Will Dilg as its president. A year later, they called for the creation of a 300-mile long Mississippi River national preserve that would protect all of the bottomlands from drainage between Lake Pepin, Minnesota, and Rock Island, Illinois. Congress responded and established the Upper Mississippi River National Wildlife and Fish Refuge in 1924. I was fortunate last summer to fly along the length of the refuge with some of the leaders of the Izaak Walton League of America (Ikes). The Upper Mississippi's prime habitats and wild beauty remain, and four generations have enjoyed the fruits of the Ikes' labor.

Dust Bowl Crusaders

To truly understand the Refuge System and wildlife conservation in North America, we must recall the 1930s. In 1929, there were 82 refuges, and plans were being made to increase the number to at least 100. But, the bottom was about to fall out, not just in the stock market. The nation plunged into

economic depression and was devastated by a gripping drought that turned much of the land into the dust bowl.

It is difficult to imagine the horrific conditions of that era. In her *Dust Bowl Diary*, Anne Marie Low (1984) wrote:

“August 1, 1936, Saturday

July has gone, and still no rain. This is the worst summer yet. The fields are nothing but grasshoppers and dried-up Russian thistle. The hills are burned to nothing but rocks and dry ground. The meadows have no grass except in former slough holes, and that has to be raked and stacked as soon as cut, or it blows away in these hot winds. There is one dust storm after another. It is the most disheartening situation I have seen yet.

Livestock and humans are really suffering. I don't know how we keep going.”

Drought conditions wreaked havoc on waterfowl populations. Fortunately, there were extraordinary people who were willing to rise to this great conservation challenge. Three individuals stand out: J. N. “Ding” Darling, Ira Gabrielson and J. Clark Salyer II. The wildlife profession was beginning to emerge with new scientific approaches to managing and restoring land for wildlife. Aldo Leopold published *Game Management* (1933), the first textbook on wildlife management. With their leadership, a cadre of wildlife professionals and citizens who cared about wildlife would advance the cause of conservation in unprecedented ways.

Darling, also known as the man who saved ducks, was Chief of the Bureau of Biological Survey (Bureau) in 1934 and 1935. Three million acres of land were set aside as wildlife refuges during his watch. When the Migratory Bird Hunting Stamp Act was passed in 1934, he designed the first stamp, which then sold for one dollar toward the purchase of refuges. Today, the sale of federal duck stamps have raised approximately \$500 million for more than 5 million acres of our best waterfowl habitat in the Refuge System. Darling also designed the blue goose symbol, which remains as the official symbol of the Refuge System.

Like many of us, Darling was frustrated by bureaucracy. He left the Bureau in 1935 and convinced Roosevelt to call the first North American Wildlife Conference in 1936. From that conference and Darling's vision grew the General Wildlife Federation—forerunner of the National Wildlife Federation—with Darling as its first president.

But, he left the Bureau in good hands. Gabrielson succeeded Darling as Chief of the Biological Survey, and he served as the first director of the modern U.S. Fish and Wildlife Service (Service), from its creation in 1940 until 1946. He oversaw a four-fold expansion of the Refuge System. His passionate testimony and work on Capitol Hill helped to rally a national effort to restore waterfowl populations. He worked to assure passage of the Federal Aid in Wildlife Restoration Act, in 1937, and the Bald Eagle Protection Act, in 1940. He oversaw the dedication of Patuxent Research Refuge in 1939. When he left the Service in 1946 to become the president of the Wildlife Management Institute, he left a legacy of tireless advocacy for waterfowl and refuges.

When Darling came to Washington, DC, he brought with him a dynamic and energetic young Midwesterner, Salyer, to manage the fledgling refuge program. In 1938, Salyer was appointed as the first chief of the new Division of Wildlife Refuges. He was famous for driving through the prairie in his station wagon, staying in the homes of refuge families along the way and identifying the most promising new areas. His leadership as Chief of Refuges inspired generations of young refuge managers, and he provided focused leadership for the Refuge System, a critical role in an increasingly multifaceted Service.

For the 31 years, until his death in 1966, Salyer was the primary, driving force in selecting new refuge areas, campaigning for their acquisition, defending their integrity, protecting the wildlife which they harbored and seeing that refuges were administered and managed to best serve the wildlife resource. He is truly seen as the father of the Refuge System.

The places that Darling, Gabrielson and Salyer worked so hard to protect live on as permanent testimony to their passion, vision and leadership—places with magical names like Arrowwood, Sand Lake, Tamarac and Agassiz. These are refuges I have visited as Director of the Service, as well as the Okefenokee, Delta and Willapa. They remain wild and free because of their early efforts.

It is hard to imagine how the Refuge System might have been built by lesser people in lesser times. At the end of the 1930s, there were 266 national wildlife refuges, protecting 13.5 million acres. It is fitting that today on Upper Souris Refuge in North Dakota, the 10,000-acre Lake Darling, named in Darling's honor, supplies water to the marshes on the J. Clark Salyer Refuge, 110 miles downstream.

While these three men provided the leadership for refuges in the 1930's, they were backed by thousands upon thousands who worked at 35 civilian

conservation corps (CCC) camps on refuges in 25 states. The legendary work of the CCCs lives on in the great refuges they helped to create—places like Seney in Michigan, Mattamuskeet in North Carolina and Saint Marks in Florida. These hardworking young men were the forerunners of today’s refuge maintenance professional, who any refuge manager will tell you are the heart and soul of modern refuges.

Partner Power

Government managers and other scientists were not the only ones alarmed about the dust bowl’s devastating effects on waterfowl. Sportsmen and sportswomen worried about the future of waterfowl and wanted to help. One such man was Joseph P. Knapp. Knapp was a successful businessman and a dedicated hunter. He decided to do something to help restore waterfowl populations and formed a group called More Game Birds In America.

In 1937, Knapp’s group chose the place to begin its first wetland work—Canada. It also chose a new name for themselves—Ducks Unlimited, Inc. (DU). It planned to raise money in the United States to help pay for wetland work in Canada. They thought it would take five years and several million dollars to bring back the ducks. Since its beginning, DU has raised more than 1 billion dollars and has helped to protect or to improve more than 8 million acres of wetlands across North America. Countless DU projects have helped to restore and enhance wetlands on national wildlife refuges.

Building the Network

As the next decade unfolded, the nation’s attention turned to war. The U.S. Department of the Interior turned over its headquarters building to the war department and the Service relocated to the Merchandise Mart in Chicago. Howard Zahniser, a brilliant writer in the Service’s public affairs office, decided to stay behind. He went on to join his former colleague, Olaus Murie, to organize the fledgling Wilderness Society, and he would later become the primary author of the Wilderness Act.

Kenai and Kodiak were added in 1941, protecting their giant moose (*Alces alces*) and brown bears (*Ursus arctos*), as was Parker River, where I enjoyed many quiet moments watching shorebirds during my years in

Massachusetts. When Florida's Chassahowitzka Refuge was added in 1943, no one could have imagined that one day it would be the winter host for endangered whooping cranes (*Grus americana*), which today travel there all the way from Necedah Refuge in Wisconsin.

The 1950s saw the birth of 24 new refuges, including Loxahatchee in Florida. This great refuge secured the northernmost part of the remaining Everglades. Today, it is a cornerstone in broader efforts to restore the Everglades ecosystem.

Kirwin was established as the first refuge in Kansas in 1954; Quivira was added the following year. I often enjoyed the fall migration at Quivira, where 500,000 geese, 100,000 ducks and 150,000 sandhill cranes would fill the skies. Quivira is a great example of how refuges are part of a broader network of conservation lands. Not far to the north lies the Kansas Cheyenne Bottoms Wildlife Management Area. Like Quivira, it has been designated as a wetland of international importance under the Ramsar Convention.

The 1950s were a pivotal period in North American conservation history. Leopold's *Sand County Almanac* (1949) had recently been published. The beginnings of a new, ecologically-based conservation movement were on the horizon. The dominant utilitarian conservation paradigm was being questioned by a few farsighted scientists, such as Olaus Murie who, like Leopold, embraced the notion of a land ethic.

In the late 1950s, Alaska Regional Director, Clarence Rhode, advocated including the entire watershed in a new refuge at Izembek and a vast landscape as an arctic wildlife range. He would die when the Grumman Goose he piloted crashed in the Brooks Range before both areas were established as refuges in the closing days of the Eisenhower Administration in 1960.

Across the country in New Jersey, local citizens were fighting hard to keep the Great Swamp from being drained and filled to build a jet port for New York City. Their treasure became a national wildlife refuge in 1960. Who would have imagined that, in 1968, the first wilderness in the Refuge System would be designated at this New Jersey refuge, rather than somewhere in the wilds of Alaska?

While she never worked on a refuge, Rachel Carson wrote of them and urged people to respect them. She had left the Service by the time she published *Silent Spring*, in 1962, awakening the modern environmental movement. Carson's writing eloquently explained scientific concepts to everyday people, inspiring them to be concerned for the natural world.

The Endangered Species Act of 1973 provided new authority that has added more than 25 refuges to the Refuge System. Attwater prairie chickens (*Tympanuchus cupido attwateri*) still boom in Texas; Mississippi sandhill cranes (*Grus canadensis pulla*) still trumpet and dance in Mississippi; Columbian white-tailed deer (*Odocoileus virginianus leucurus*) are still protected in Washington; ancient crocodiles (*Crocodylus acutus*) still lurk in south Florida with the help of refuges dedicated to their survival.

The Final Frontier

The biggest battle of the 1970s was over the fate of Alaska's wildlands. In December 1980, more than 50 million acres were added to the Refuge System with the enactment of the Alaska National Interest Lands Conservation Act. While many know the controversy over the Arctic Refuge Coastal Plain, the value of other Alaska refuges can be overshadowed. Few think of the millions of birds produced on the Yukon Flats, know of the magic of the Koyukuk or think of the giant moose of the Innoko. Sixteen refuges protect 77 million acres of pristine habitat and the best hunting and fishing in the world. I visited Kenai, Kodiak, Alaska Peninsula Refuge and Becharof Refuge this past summer. It was a humbling experience to visit these vast landscapes, and I look forward to being humbled by Alaska again.

The 1970s and 1980s were also a time when a number of new refuges were identified by the Service's Division of Ecological Services field personnel. With a traditional focus on river basin studies, a number of great bottomland hardwood areas, some of the most productive habitats in the world, were spared from being converted to soybean fields through the efforts of these staff working alongside their refuge colleagues. D'Arbonne, Upper Ouachita and Tensas refuges in Louisiana were all saved from the bulldozers. One refuge stands out as a great example. Bull Madden had spent many years protecting prairie refuges before he headed south to Mississippi. He was famous for his T-shirt, emblazoned with the image of a catfish and the words "save the dirt." He fought hard, along with a youthful biologist named Dan Tabberer and others, to establish the 40,000-acre Bogue Chitto National Wildlife Refuge, which links Mississippi's Old River Wildlife Management Area to Louisiana's Pearl River Management Area. Researchers recently searched in this area hoping to find ivory-billed woodpeckers (*Campephilus principalis*). If there is a chance that any of these

birds still survive, they will find a large area of protected habitat because of the efforts of Madden and his state colleagues.

As our population has grown, it has become increasingly important to protect wildlife in proximity to where people live. Urban refuges, like Minnesota Valley in Minneapolis, San Francisco Bay, Tinicum in Philadelphia and Rocky Mountain Arsenal in Denver, and Bayou Sauvage in New Orleans provide city dwellers a great escape from the hustle and bustle of everyday life, and they are places of discovery and adventure for children.

We continue to find new conservation possibilities for refuges in new places, such as Big Muddy Refuge in Missouri, where the Service is restoring aquatic ecosystems by letting the Missouri River act more like a river. There are also places like Palmyra Atoll Refuge, which protects some of the most pristine coral reefs in the world. Finally, there are places like the Northern Tallgrass Prairie, where we are now adding grassland easements to compliment existing wetland easements to provide better habitat for waterfowl and other creatures of the prairies.

Past is Prologue

The Refuge System is ready to begin its 2nd century, building on 100 years of conservation achievement. It is well-positioned for the future. We have a strong organic law with the National Wildlife Refuge System Improvement Act of 1997. We have strong authority to recruit and empower volunteers. And, we have community support, such as created with the Volunteer and Community Partnership Enhancement Act of 1998, which the Service used to help rally a *friends movement* that now includes more than 230 local community support groups. Approximately 38,000 volunteers accomplish 20 percent of all work done on refuges. We have a strategic plan for the future, called Fulfilling the Promise (USFWS 1999), which was crafted at the historic gathering of all of the Refuge System's managers at Keystone, Colorado in 1998. Our centennial celebration has brought unprecedented visibility and support for the Refuge System; the stars are aligned for it. We will need all of this and more to meet the challenges ahead.

The Service will continue to grow the Refuge System, but it will need to be much more strategic in our efforts. We need to focus on the acquisition of existing units and the certainty that we can manage them properly. Expansions of refuges may be called for, but they should focus on the best opportunities to

partner with others to protect habitat on a larger scale. Easements will continue to be a powerful habitat protection tool. New refuges will be established, but we can only add the very best areas. We must use modern techniques of spatial data analysis and modeling to identify these areas using the best available science.

The Service land management will continue to be based on science. We must develop new and more sophisticated techniques to fight invasive species that threaten to destroy the value of refuge habitats. We will continue to be the leaders in fire ecology, using prescribed fires to improve wildlife habitat and reduce dangerous fuel build ups and wildfire hazards. Refuges must continue to open their doors to researchers and to serve as natural laboratories for developing new management techniques. The new land management research demonstration areas will be powerful tools for scientific collaboration and information exchange. Refuges will continue to collaborate with other Service efforts, such as breeding bird surveys, helping to build a network of field stations engaged in long-term ecological monitoring.

The Service will continue to improve our visitor services and public safety. Our refuge law enforcement efforts will continue to improve, providing the best natural resource law enforcement program in the world. Recreational opportunities must increase in order to foster a growing constituency that cares about wildlife conservation. The incredible hunting and fishing opportunities on refuges can expand to be accessible to all citizens. I am excited about all of the possibilities and opportunities for refuges in the future.

Places of Discovery

In the course of the past century, our country has changed in many ways. There are 200 million more people inhabiting the North American landscape than there were 100 years ago. An increasingly smaller percentage of today's children grow up in a rural environment. As our cities sprawl, suburbs become surrounded by more suburbs, with fewer children living near forests and fields and streams. Exploring shopping malls and video games has replaced exploring the outdoors for many of our kids. Crime, drugs and other dangers of increasingly urban environments require parents to keep closer watch on kids, rather than letting them roam free, as was so common a generation ago. These forces combine and contribute to a new generation with a diminished understanding of the natural world.

Fewer kids know where the water they drink and the food that they eat come from. They do not understand the relation between timber and lumber, pulp and paper. They would see purple loosestrife (*Lythrum salicaria*) as a flower just as beautiful as a pasque flower (*Pulsatilla hirsutissima*), without a clue as to why they are so different. They do not hear the cry of the loon (*Gavia immer*), the song of the whip-poor-whil (*Caprimulgus vociferus*) or the music of cranes. They do not know the symphony of morning on a marsh; they have not heard a ruffed grouse (*Bonasa umbellus*) drum or a prairie chicken boom. They do not know what they have missed. Nor do we, who never saw the sky blackened by passenger pigeons (*Ectopistes migratorius*), who never heard the true thunder of bison, who never saw a Labrador duck (*Camptorhynchus labradorius*) or a California grizzly.

Yet, I see so many reasons to be hopeful about the growing success in protecting our wildlife heritage. In the past 100 years we have advanced our mission of wildlife conservation, including restoration of wood duck, elk and turkey populations, and a myriad of other wildlife species to levels far greater than when the century began. We rescued the whooping crane from the verge of extinction. We have been successful because we have accepted the challenge of protecting some of North America's landscape as wildlife habitat. We are becoming more successful as we learn how to better care for and manage these lands for wildlife. The Refuge System contributes nearly 100 million acres to this cause. And, Service employees help in the stewardship of millions more by lending their wildlife management expertise to neighbors who want to manage some of their land for wildlife.

What began as an idea at tiny Pelican Island—the notion that we must protect some land for wildlife because of their intrinsic value—has become an ideal. Our wisdom has grown, and, with humility, we have accepted the premise offered by the good Professor Leopold—that land is a community of life and that love of land is an extension of ethics. This is the first of the guiding principles of the Refuge System, the core values that never change when all else does.

With a national wildlife refuge within an hour's drive of most major cities, these places afford the opportunity for children to learn this land ethic. These are places where a child can be filled with wonder as they watch for the first time a bobber slip under the water. National wildlife refuges are places where children can see the sky filled with wild birds from far away places and fill their imaginations by wondering where the birds came from and to where they will fly.

The children will hear sounds like the piping of a plover (*Charadrius* spp.) That is sung against a chorus of wind and surf that cannot be downloaded from the Internet. And in more than one special place, they can discover a pasque flower and immediately know its special magic, which they will never forget. These are moments that can bind families and friends together, gently soothing our ancient urge for a connection to the natural world. In our frantically-paced world, opportunities for adventure and exploration coupled with moments of solitude and reflection are a prescription for the stresses we all feel.

We can teach our children about the land and the natural world or perhaps learn along with them. Finding the time to spend in the great outdoors with children is our greatest challenge and opportunity, it is where we will raise the next generation of conservationists. We can instill in them a sense of what it truly means to be a North American by teaching them about the natural history of our land.

The Refuge System alone will never protect our nation's rich wildlife heritage, but these lands can showcase our shared mission and work of conservation to the world. Refuges can connect people with wild places and wildlife.

Conclusion

Tiny Pelican Island stands in stark contrast with the vast, rugged landscape of Kodiak Island. As I have visited these places during the past year, I am struck by what they have in common. Pelican Island was established as our first national wildlife refuge by Roosevelt in 1903. Another President Roosevelt—Franklin—set aside nearly 2 million acres of Kodiak Island in 1941 as a refuge for giant bears. Two presidents from two generations and two political parties advanced the same cause—wildlife conservation.

We need to build on the lessons of the past 100 years. All those interested in conserving North America's wildlife heritage need to work together. We need each other. The challenges we face, in a country with 200 million more people than were present a century ago, are too daunting for any group to face alone. We need unity, broad coalitions of conservationists finding common ground. That common ground is the land and our love of it. I am thankful to all those who have worked over the past century to protect nearly 100 million acres of land for all generations to come.

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Long-term Challenges for Our Nation's Refuges

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America's national wildlife refuges form the core of the U.S. system of wildlife management. Each unit of the National Wildlife Refuge System (System) faces challenges that vary, from minor, temporal issues to major threats to their very existence. These are joined by overarching challenges that go beyond any individual unit. Such issues as the management of exotic species, water quantity and quality, loss of focus, compatible and incompatible uses, and climate change impact our refuges and the ecosystems they represent. While our refuges encompass approximately 4 percent of the nation's land, they are only a segment of the landscapes upon which our wildlife depends. Encroachment on refuges will limit their effectiveness, and failure to recognize that the surrounding landscape is critical will prevent species' recovery or limit abundance. Demands on refuge lands and waters by users and neighbors only will increase and the system is not well-prepared to handle those. Most narrow issues can be addressed by improved operations and maintenance funding, strengthened professional staffing and training, and improved local support and cooperation among the U.S. Fish and Wildlife Service (FWS), partners, communities and Friends organizations. Addressing the larger issues will take major infusions of funding, modifications of policy, intense involvement of national partners, public recognition of the value of the System and improved vision of what the System is and can be. We must strengthen public knowledge of and support for our refuges without turning them into national parks. The U.S. Department of the Interior has fiduciary and moral responsibilities to the North American public and the many partners who continue to invest their time, talent and treasure in the future of the System. Leadership from the FWS, Congress and nongovernmental organizations (NGOs) must improve if we are to successfully meet the challenges facing our national wildlife refuges and, indeed, our nation.

North America's national wildlife refuges, as the core of the U.S. system of wildlife management, have a rich history of wildlife conservation related to the 539 units of protected lands. From President Theodore Roosevelt's establishment of the 5.5-acre Pelican Island National Wildlife Refuge (Pelican

Island) as the first national wildlife refuge in 1903 to a network of over 94 million acres in 2003, this system of conserved lands is not only the largest in the world, but the most envied. But, all is not perfect for our nation's refuges. These lands—and the FWS that is charged with their care—are besieged by threats and challenges. Every unit of the System faces challenges ranging from minor, temporal issues to major threats jeopardizing their very existence. This is not new and our challenge today and tomorrow is to determine how to reduce or eliminate those threats.

Historical Context

The purchase of a unit of land does not constitute its protection. When President Theodore Roosevelt set aside Pelican Island, that act alone was not enough to stop the plume hunting and collecting that threatened the destruction of wading birds. It took active management via law enforcement to provide the conservation that the birds and the land needed. Today, Pelican Island is still threatened and, without active management to stop erosion, increase acreage and perform other forms of management needed, it will not survive. The same is true of every part of the System.

In 1934, J. Clark Salyer II appeared before Congress to discuss the need for waterfowl restoration (Salyer 1934). Salyer was one of the early champions and leaders of the System. The Migratory Bird Hunting Stamp Act of 1934 required duck and goose hunters to purchase a duck stamp to hunt. The funds from these stamp sales were to be used to acquire lands to be managed for waterfowl. Those lands became part of the System. While they were of considerable significance to the System, Salyer recognized that those funds alone were not adequate to implement the program waterfowl must have. At the time Salyer made his report, our continent was in drought, waterfowl were in trouble and many people thought many wildlife species would be extinct in only a short time. That same year, Thomas H. Beck, Jay N. Darling and Aldo Leopold were members of a presidential commission that recommended a, “plan to withdraw by purchase submarginal lands unsuited for profitable agricultural use. . . to carry out a vast and pressingly urgent national program for wild-life restoration” (Beck et al. 1934). That commission recommended the acquisition of 4 million acres for migratory waterfowl and shorebird breeding and nesting, 5 million acres for upland game immediately and an additional 5 million for later purchase, 1 million

acres for song and nongame birds, 2 million acres for big game, fur-bearing mammals and other valuable mammals. And, it recommended that \$25 million be allotted for restoration and improvement of all these lands. The plan by Beck, Darling and Leopold was a bold plan for its time, and Salyer recognized that more than just duck stamp funds would be needed to put that plan into action. Salyer further recognized that challenges existed beyond the need to acquire the land when he emphasized that water supplies were a critical element of any system of land set aside for wildlife of all types.

During World War II, the plight of wildlife and their conserved lands was pushed a bit to the side, but at gatherings of professionals, such as the North American Wildlife and Natural Resources Conference, the future challenges faced by our national wildlife refuges were front-of-mind. Clarence Cottam (1945) cataloged many of the issues affecting research on national wildlife refuges. His list is not unlike that of today and it included control of: obnoxious vegetation, depredation by wildlife, harvest of wildlife, game and endangered species restoration, disease, chemical contamination, livestock and agricultural influences. Lists of challenges have become more refined today, but I believe they would be recognizable to those early pioneers of the System.

The Challenges

The one significant challenge that has plagued our refuges since the beginning is the lack of sufficient funds to manage the System appropriately. From the establishment of the first refuge to today, we have not allocated enough funds to the System to meet its needs. The Cooperative Alliance for Refuge Enhancement (CARE) has put this case before the North American public and Congress over the last several years.

CARE has documented a shortfall of \$2 billion that is needed to improve management and restoration of the land, collect important scientific data, provide for educational opportunities, enable appropriate recreational use and keep the many facilities on refuges in a reasonable condition. CARE has proposed that this shortfall be made up by increasing the System's budget to \$700 million, annually, which would bring its per-acre budget to only 47 percent of that of the U.S. National Park Service.

Increased funding for the System is critical, but it is not the only challenge our refuges face. Every unit of the System has its own unique problems from

neighborhood relations to intrusions of development to disputes over incompatible uses. Those problems have been cataloged, and I do not intend to list them all here. However, some of these problems rise to the level of System-wide challenges.

In my opinion those System-wide challenges include: invasions of exotic species of plants and animals, problems of water quality and quantity, chemical contamination, user demands, lack of scientific data, loss of landscape features, climate change impacts and leadership problems. Increased funding will address many of these challenges, but some require better policies and education of decision makers, legislators and the public.

Exotic invaders are a problem on many refuges just as they are a problem on a larger scale, the ecosystems. For instance, numerous species of foreign plants have invaded our nation's lands and waters. Some are obvious while others are almost never noticed by humans. There is merit in working to prevent invasions of national wildlife refuges and even to remove invaders when possible. This is not just a refuge problem. Eliminating nutria from Blackwater National Wildlife Refuge will do no good so long as nutria continue to exist in the surrounding landscape. Killing and removing water hyacinth will be a temporary measure if the plant is still in the watershed. Our nation is faced with a tremendous loss of biodiversity due to invasive species displacing native plants and animals. While I applaud attempts to fix such problems on national wildlife refuges, the challenge is much broader than simply protecting separate, scattered areas of habitat. And, it will not be solved by only working on refuges.

One of the more difficult challenges we face with the System is the question of water quality and quantity. The problems with water on Klamath National Wildlife Refuge, for instance, have brought the issue to public attention, but much more must be done to address water and refuges (Wentz 2000).

Climate change is another factor that is beyond the control of the refuge manager. All of our refuges will be subject to considerable change if any of the predictions on climate change are accurate. While some things may be done on the ground, we need major policy changes at the national and international level to address climate change.

These examples and others lead me to conclude that one of our greatest challenges with the System is its treatment as a series of islands (Wentz and Reid 1992), or small, disseminated areas of land. Our refuges cover approximately 4 percent of our nation's land, but, even then, they are only a small segment of the landscapes upon which our wildlife depends. There is a strong tendency for us to want to create a wall around a refuge and look at its management myopically.

That will ensure its eventual destruction. While a few individual refuges may be large enough to be managed as an ecosystem, most are too small for that.

Encroachment on refuges will limit their effectiveness and make it impossible to properly manage that unit and the wildlife that depend on it. We must recognize that the surrounding landscape on all refuges is critical to our ability to realize the goals set up for each refuge. Failure to do this will prevent species' recovery and limit the abundance we might be trying to achieve with some species. Demands on refuge lands and waters by users and neighbors will only increase, and the system is not prepared to handle those.

Most narrow issues can be addressed by improved operations and maintenance funding, strengthened professional staffing and training, and improved local support and cooperation among the FWS, partners, communities and Friends organizations.

Addressing the larger issues will take infusions of funding, modifications of policy, more intense involvement of national partners, public recognition of the value of the System and improvement in vision of what the System is and can be.

Solutions and Opportunities

There are no quick fixes of the challenges facing the System. Yet, there are solutions and opportunities that hold great promise.

First, and foremost in my mind, we must strengthen public knowledge of and support for our refuges. Few understand the distinctive qualities and values of the System in spite of the current level of visitorship. Those who care about refuges must make public knowledge of the System a priority. We can do that by ensuring we give the System a higher profile not only in all of our NGO publications, such as *National Wildlife*, but seeking greater exposure to those who are not members of our various conservation groups, such as was done by *National Geographic* and the television spots that are now appearing on *ESPN Outdoors*. So far, we have not made that a priority for the 100th anniversary of the System, but we still have some time left this year and can continue efforts in future years. Without broader public support it will be very difficult to improve the status of the System.

Landscape Solutions

The FWS must think more clearly that national wildlife refuges are not simple islands of habitat that they can protect and manage. While the refuge itself

will be an intensively managed unit of land, it must be considered in the context of the landscape around it. Comprehensive refuge planning is a good thing, and it will be even better if the refuge is considered a part of a larger ecosystem and plans put the refuge in a full landscape context. While most refuges are substantial units of land to be effective, wildlife resources will typically require even larger conserved areas if populations are to remain viable. That means creating active partnerships with other landowners, state and local agencies, and NGOs on entire landscapes.

One approach is that refuges can be thought of as anchor properties with extended, protected, managed landscapes around them. The refuge could be surrounded by a complex of managed public and private wildlife and recreation lands, private lands protected by conservation easements, greenways, corridors and other innovative approaches.

The ACE Basin Task Force (for the confluence of the Ashepoo, Combahee and Edisto rivers) has used this surrounded refuge approach in its efforts to secure permanent conservation of 350,000 acres of the ACE Basin in South Carolina. The ACE Basin National Wildlife Refuge and state wildlife areas are surrounded by lands owned and managed by NGOs and by substantial conservation easements held by the private partners. This effort grew out of the North American Waterfowl Management Plan and expanded to include numerous private partners and landowners who wished to see the natural character of the landscape protected for future generations. This approach is timely. Over the next two decades, we will see the most substantial transfer of wealth, including land, that has ever occurred in history. As Tom Brokaw's "Great Generation" passes on, they will leave behind a land legacy estimated at over \$25 trillion that will include substantial transfers of land to the next generation. This is a time of great danger and opportunity for conservation. Typically, when wealth transfers, the government expects to be paid substantial taxes on the inheritance. When that transfer involves land, the heirs often must subdivide and sell part of the land for development or substantially change its character by selling timber or bringing the land into cultivation in order to have the cash the government demands. Those changes can be very damaging to the natural characteristics of the land. However, donated conservation easements or donations of the land can help heirs protect that transfer of wealth and lead to protection of the land. And, they can help to secure land around important refuges and come closer to protecting whole ecosystems.

This is an opportunity that will not occur again and we, as a community of conservationists, must take advantage of it now.

Partnerships

Perhaps the greatest opportunity for the System over the next few decades is to develop and expand partnerships. Numerous NGOs and state agencies currently partner with the System to accomplish mutual objectives. These partnerships have added land, improved management capability, created new knowledge and added value to the System. Active partnerships with the System include those with a variety of national and local organizations and those with the recently formed Friends groups, which typically are local groups who work to support the needs of a particular refuge.

Some of the national partnerships, such as those of The Nature Conservancy (TNC) and Ducks Unlimited, Inc. (DU) have been long-standing. For instance, TNC has completed 1,173 acquisition projects relating to the System. They have added 1.5 million acres to the System at a cost of approximately \$400 million. Their ability to acquire land at less than appraised value has saved the System over \$100 million (M. Dennis, personal communication 2003). During 1985 to 2002, DU completed over 1,100 projects affecting over 558,000 acres of national wildlife refuges. These projects included acquisition, restoration and enhancement. As part of our Alaska Earth Cover Mapping Program, DU has used satellite imagery to map nearly 19 million acres of 8 national wildlife refuges in Alaska. Those databases and map products are used as management tools by the FWS. Efforts, such as those by TNC, DU and The Conservation Fund, combine public and private resources to accomplish more than either party could independently.

But, to meet the challenges of the future, these partnerships must become more extensive and intensive. The following paragraphs briefly explain an example of the kinds of partnerships that we will need to keep the System viable (Wentz 2000).

The complex of native grasslands and wetlands that we call the Prairie Pothole Region is some of the most important migratory bird habitat left on the continent. Waterfowl biologists have long recognized the importance of this area by naming it the Duck Factory. But it is important for more than just ducks. Numerous species of shorebirds, wading birds, raptors, grassland songbirds and other species utilize this region for nesting or migration habitat (Wentz and Reid

1992). At the same time the majority of this landscape has been converted to agricultural cropping use. The natural cover that remains is impacted by regular grazing and haying.

Because of the value for waterfowl and other wildlife, the FWS has a heavy concentration of national wildlife refuges, Waterfowl Production Areas and lands under perpetual easement in the Prairie Pothole Region. Yet, a significant part of the landscape is not protected. If it is lost to agriculture, the work of the FWS will be problematic.

The Prairie Pothole Region has been a battleground over wetlands and cover for generations. Trying to farm the flatter lands of the eastern Dakotas was a battle against nature subsidized by the federal government. Wetlands, ducks and other waterbirds suffered as a result. But, throughout the last several decades of this fight, biologists have usually felt that the potholes and grasslands of the Prairie and Missouri Coteaus, those rolling hills created by glacial action that extend from southeastern South Dakota along the Missouri River northward through North Dakota and on into Saskatchewan, have been reasonably secure from drainage and plowing due to terrain and soil types. But, large-scale irrigation projects and the development of specialty crops, such as potatoes, have shown us that this is not true. Across the border in Canada, nearly all of the same Coteau landform has been put into active cultivation with the loss of nearly all the natural cover and wetlands.

As a result, DU, the FWS and several other partners in the Dakotas have set upon a joint effort to protect this area by securing fee title or perpetual grassland and wetland easements on an additional two million acres, which is about one-quarter of the best remaining duck habitat (Ringelman 2002). DU will take direct ownership of at least 72,000 acres in the Dakotas by purchase or donation, will secure 100,000 additional acres of easements by donation and will expect to purchase conservation easements on the remaining acreage. The venture will cost at least \$120 million, not counting future management costs.

DU is buying easements in defined areas, where we know that duck production is high. Staff from DU and FWS identify and negotiate the purchase of conservation easements on the land and wetlands, DU pays for the easement, FWS takes ownership and the FWS has future management and enforcement responsibility. The grass cannot be plowed, but it can be hayed or grazed after the peak of the nesting season of each year. We are locking in a rangeland economy on the property forever. As a result, waterfowl and other wetland-dependent birds

and wildlife will have an intact grassland ecosystem that will not be modified in the future. Obviously, the landscape is still subject to drought, but at least it won't be converted into irrigated potato fields as we have seen in some areas.

In those places where easements cannot be purchased for a variety of reasons, DU intends to buy the property. Once fee ownership is acquired, we restore the land to grassland. After the grass is well-established and wetlands have been restored, we intend to sell most of these areas with appropriate deed restrictions to prevent any change in the basic landscape.

Of course, we face some of the traditional problems in buying land in the Dakotas, especially if we intend to transfer much of it to the government. We obviously work only with willing sellers, but there is a high sensitivity to who owns land in the region and what is done with it. We have had strong support from the farming and ranching community, since it would rather deal with DU as mediator than negotiate directly with the federal or state governments. In the case of North Dakota, where state laws prevent or limit the amount or type of ownership by private wildlife groups, there may be challenges to the program. However, given the very strong interest of landowners in seeing this program develop, we do not expect challenges to be successful.

Securing such large units of this landscape will limit the ability of government and individuals to use the water and land for other purposes through an active form of ecosystem management. We are accomplishing dual purposes of securing water and cover with the intention of protecting the entire habitat base for wildlife over extensive landscapes at reasonable costs.

This is being done in cooperation with the current generation of farmers and ranchers who have many motivations. Some want to preserve a way of life and see permanent easements as the way to do so. Others recognize that much of this land should never have been used for crops and they want to return it to rangeland. Still others need the finances to be able to sustain their farming, ranching operations or retirement.

In any case, we have a limited window of opportunity for a massive exchange of land, which is currently underway and will continue the next two decades. If we fail to act now to protect these habitats, there may never be another chance.

This is the type of partnership that we must develop if these landscapes are to remain viable and the System is to remain the core of migratory wildlife abundance.

Policy and Funding Solutions

Some of the most difficult problems the System faces can only be solved by better and more comprehensive policy support in the FWS, the U.S. Department of Interior, the executive branch and Congress. We have at least one excellent model of how that approach can work.

CARE is an assemblage of 20 of our nation's conservation organizations, designed to work for increased funding for the System. CARE has identified a \$2 billion shortfall in funding for refuges, and they have proposed that the System's annual budget be doubled to \$700 million a year to take care of the current and future shortfalls. The group has enjoyed success with significant annual increases from Congress and higher proposed budgets from the Administration.

Perhaps the most significant things about CARE do not include its success but its diversity of organizations and its tenure of remarkable agreement on a single goal—greater funding for refuges. That model shows us how to coalesce around an important goal and not split over details.

CARE funding is primarily focused on operations and maintenance needs of the System. That is a high priority. But, more funding is also needed to help fill in all those blank spaces within authorized refuge boundaries. The backlog of funding needs for land acquisition is very significant, and Congress and various administrations have not provided sufficient funds to address real needs in this area. Taking care of what we already own, which has been a battle cry of many, is critical. But, authorized refuge acquisitions must be funded more quickly. Land rarely gets cheaper, and the failure to find funds has immediate consequences for current landowners who are willing sellers who are forced to wait for appropriations or find other buyers. The long-term consequence for the nation is higher cost for the land, more conflict as new owners are unwilling to sell and loss to development and other uses of natural landscapes that wildlife and humans need.

The U.S. Department of Interior has significant fiduciary and moral responsibilities to the North American public and the many partners who continue to invest their time, talent and treasure in the future of the System. Leadership from the FWS, Congress and NGOs must improve if we are to successfully meet the challenges facing our national wildlife refuges and, indeed, our nation.

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The Role of the National Wildlife Refuge System in Conserving Threatened and Endangered Species

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From its very beginnings in 1903 when President Theodore Roosevelt established three-acre Pelican Island, “as a preserve and breeding ground,” for the brown pelican (*Pelecanus occidentalis*) and other native birds, the National Wildlife Refuge System (NWRS) has played a key role in conserving threatened and endangered species. Although the brown pelican would not be listed as an endangered species for another 67 years, at the turn of the 20th century many colonial nesting birds already were in great jeopardy from commercial exploitation for plumes and feathers. Protection of Pelican Island National Wildlife Refuge (Pelican Island), which was the last breeding ground for brown pelicans along the entire east coast of Florida, was an important use of refuge establishment to protect an imperiled species. Today, the Atlantic coast population of brown pelicans is no longer in need of Endangered Species Act (ESA) protection, but Pelican Island continues to provide habitat for nine other listed endangered and threatened species. More than 30 other national wildlife refuges (NWRs) provide habitat for other populations of brown pelicans, which remain endangered.

The U.S. Approach to Endangered Species Conservation

From the time Pelican Island was protected as a federal bird reservation until passage of the nation’s first ESA in 1966, efforts to conserve imperiled species primarily relied on establishment of reserves of one form or another. It is hardly surprising, therefore, that it was Section 4 of the 1996 ESA that formally established the National Wildlife Refuge System and consolidated various land management authorities in what, subsequently, was named the National Wildlife Refuge System Administration Act. By 1973, however, the House of Representatives’ ESA sponsor, John Dingell, would declare that the, “existing laws are sound, as far as they go, but later events have shown that they do not go far enough” (1973). The ESA enacted in 1973, therefore, took a more comprehensive approach to integrate endangered and threatened species

conservation into federal agency activities as well as into activities on state and private lands. Acquisition of refuge lands remained an element of the ESA, but it was no longer as prominent a means of achieving the ESA's goals.

Under the ESA, species determined to be either in danger of becoming extinct (endangered) or likely to become endangered (threatened) are provided two types of protection: it is illegal for anyone to kill or harm an individual animal or plant of a listed species, and all federal agencies are required to ensure that they don't fund or support activities that would jeopardize the existence of a listed animal or adversely modify habitat critical to that species. Together, these protections have had a pervasive effect on the management of the nation's public and private lands and waters. The NWRS has played an important role in preventing extinctions and recovering species, but implementation of the ESA's largely regulatory protections, rather than establishment of reserves within the NWRS, has been the dominant approach to conservation of imperiled species in the United States over the last three decades.

Examples of the Roles of National Wildlife Refuge System Units

Many units of the NWRS were established solely under the authority of the ESA to conserve species listed as endangered or threatened. These NWRS units seek to protect and aid the recovery of some of the best-known endangered and threatened species and some of the most rare and obscure imperiled species. James River NWR in Virginia, for example, provides habitat for the threatened bald eagle (*Haliaeetus leucocephalus*), while Ash Meadows NWR consists of more than 22,000 acres of spring-fed wetlands and alkaline desert uplands in Nevada, which provide habitat for at least 24 plants and animals found nowhere else in the world. This concentration of endemic life includes 12 species listed as endangered or threatened. The 6,535 acres of Kirtland's Warbler Wildlife Management Area in Michigan are managed to maintain nesting habitat for this endangered songbird (*Dendroica kirtlandii*). Crocodile Lake NWR (6,686 acres) and Florida Panther NWR (23,379 acres), in Florida, were established under ESA authority for their namesakes. The 32,733 acres of Hakalau Forest NWR, in Hawaii, was set aside to protect and manage eight endangered forest birds and their rain forest habitat, as well as two endangered plants and the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*). Buenos Aires NWR, which comprises 116,585 acres in Arizona and is the largest of the refuges established solely under ESA authority, provides habitat for the endangered

masked bobwhite quail (*Colinus virginianus ridgwayi*). The smallest of the NWRs established for endangered and threatened species is the seven acres of Watercress Darter NWR, in Alabama, which protects this endangered fish.

Many other units of the NWRS were established, in part, using the acquisition authority of the ESA, or portions of these units were acquired with that authority. Blackwater NWR in Maryland, for example, consists of lands and waters acquired under the authority not only of the ESA but of the Migratory Bird Conservation Act, the Emergency Wetlands Resources Act, and the North American Wetlands Conservation Act. Others, such as Sheldon NWR, in Nevada and Oregon, and Pelican Island, were established initially by executive order and later utilized ESA authority.

The majority of NWRS units were not acquired or added to under the provisions of ESA, but they provide habitat for one or more ESA-listed species. A large number of the NWRS units established for migratory birds provide habitat for bald eagles. Some of these units, such as Tule Lake NWR in California, not only provide habitat for migratory birds and bald eagles but also for other listed species. Tule Lake NWR, for instance, also provides habitat for endangered shortnose suckers (*Chasmistes brevirostris*) and Lost River suckers (*Deltistes luxatus*).

Opportunities for a Greater Role in Recovery of Listed Species

For those NWRS units established pursuant to the ESA, a key purpose is to assist in achieving the ESA's goal to bring species back to the point at which the measures provided by the ESA are no longer necessary. As might be expected, recovery plans for listed species generally appear to identify management or research actions on ESA-established NWRS units to promote recovery. There are exceptions, however. The recovery plan for the Hawaiian hoary bat, for example, does not mention Hakalau Forest NWR; although, the species is found on that refuge but on no other refuge (U.S. Fish and Wildlife Service 1998).

On NWRS units that report occurrences of listed species but that were not established solely for ESA purposes, the link with recovery planning is more fragmented. The recovery plan for the endangered least tern (*Sterna antillarum*), for example, addresses limited management and monitoring actions on four NWRS units, but does not mention the other 33 NWRS units on which the species occurs (U.S. Fish and Wildlife Service 1990). One of these 33 units,

Reelfoot NWR, in Tennessee and Kentucky, was established, in part, for ESA purposes yet still is not mentioned in the recovery plan. Similarly, the recovery plan for the threatened Atlantic coast population of the piping plover (*Charadrius melodus*) mentions only 6 of the 21 NWRS units within the population's breeding range on which the species is found (U.S. Fish and Wildlife Service 1996a). None of the approximately 24 NWRS units within the species' wintering range are mentioned.

Examples of this disconnect between recovery plans and NWRS units also exist for lesser-known species. The recovery plan for the endangered American burying beetle (*Nicrophorus americanus*) fails to mention any of the four NWRS units on which the species is present (U.S. Fish and Wildlife Service 1991). The recovery plan for the western prairie-fringed orchid (*Platanthera praeclara*) describes Valentine NWR in Nebraska as a priority search site, but does not mention the other 11 NWRS units on which it is listed as occurring, while the plan for the eastern prairie-fringed orchid (*Platanthera leucophaea*) mentions none of the NWRS units on which it is reported to be present (U.S. Fish and Wildlife Service 1996b, 1999).

It is not clear how common an occurrence it is for a species' recovery plan to fail to mention the NWRS units utilized by that species or to fail to incorporate activities on those units into recovery strategies. Many, perhaps most, recovery plans appear to utilize NWRS units to some extent to achieve recovery objectives. It also is unclear how to interpret the failure of at least some recovery plans to mention or integrate NWRS units into the plans. It could mean that refuges are not engaged in any activities in behalf of the species addressed in the recovery plan. Or, it could mean that recovery teams and others involved in the preparation of recovery plans are not aware of the species' occurrence on those refuges or of actions being taken in their behalf. In any case, there is an opportunity for some, perhaps many, NWRS units to play a much greater role in the recovery of endangered and threatened species and for the recovery plans to rely more heavily on NWRS units to achieve their objectives.

Opportunities to Give Higher Priority to Acquisitions That Fulfill Endangered Species Act Goals

To address a backlog in NWRS land acquisition, which is now about 2 million acres and \$3 billion, in a manner that meets its trust resource obligations

and legislated responsibilities, the U.S. Fish and Wildlife Service (Service) developed the Land Acquisition Priority System (LAPS) to build land acquisition budget requests. The LAPS establishes land protection priorities among the most important habitat conservation projects using a compilation of 850 possible points that have been assigned to a comprehensive series of questions. The points are apportioned as follows: project summary (50 points), fisheries and aquatic resources (200 points) endangered and threatened species (200 points), bird conservation (200 points) and ecosystem conservation (200 points). Projects that would prevent extinction of a species or result in delisting of a species under the ESA are awarded the maximum 200 points in the endangered and threatened species LAPS category. This system clearly rewards projects that score high with respect to all four categories of trust resource obligations. For fiscal year 2004, for example, Big Muddy National Fish and Wildlife Refuge, in Missouri, ranks first in the LAPS list with 686 points out of 850 points because it scores 165 points or greater in each of the four resource categories. This approach certainly makes some sense. However, there are 10 land acquisition projects on the fiscal year 2004 LAPS list that score 200 points in the endangered and threatened species category and rank from 13 to 114 out of a possible 143 projects. If funding each of these projects actually would, as represented, either prevent the extinction of a species or result in a delisting proposal going forward, then the LAPS seems questionable and in need of revision.

Certainly, the easiest way for the NWRS to play a more significant role in the conservation of ESA-listed species would be to give highest priority to those projects that score 200 in the LAPS endangered and threatened species category. Indeed, one might argue that section 7(a)(2) of the ESA actually requires priority to be given to projects that would prevent extinction. Adherence to the affirmative duty imposed by section 7(a)(1) of the ESA to bring species back to the point at which the measures provided by the ESA are no longer necessary also would require giving priority to projects that would accomplish recovery.

Limits on the Efficacy of the National Wildlife Refuge System

There are limits on the efficacy of the NWRS as a mechanism to conserve species listed under the ESA. Only 57 NWRS units have been established for listed species under ESA authority in the 30 years since the law's

enactment. The ESA units are relatively small; median size is just 1,023 acres. Overall, more than 80 percent of the NWRS units provide habitat for one or more species listed under the ESA. However, a few relatively common, listed species, such as the bald eagle, account for this high rate of occurrence. Greater than 40 percent of all listed mammals, birds and reptiles are not found on any unit of the NWRS. Of listed fishes and amphibians, approximately three-quarters are not present on NWRS units. Even more striking is that roughly 85 percent of listed plants and invertebrates are not protected under the NWRS.

The effectiveness of the NWRS in conserving endangered and threatened species also is constrained because some NWRS units established for endangered and threatened species are isolated, not well connected with other lands and waters managed for conservation purposes. Moreover, Gergely et al. (2000) note that refuge units generally are far smaller than the areas over which large-scale disturbances operate, which presents significant challenges for long-term maintenance and recovery of imperiled species. NWRS units also represent only a very small percentage of U.S. ecosystems. Scott (1999), citing Crumpacker et al. (1988), notes that Service holdings accounted for only five (3.7 percent) of the 135 potential vegetation types in the conterminous states identified by Kuchler (1964).

Although the NWRS continues to expand at an increasing rate, there also clearly are limits on how much land can be set-aside in the NWRS for endangered and threatened species conservation and for other purposes. In the 21 years spanning fiscal year 1982 through fiscal year 2002, 5,147,319 acres were added to the NWRS from the public domain and through federal agency transfers, donations, purchases, leases, easements and refuge overlays (secondary jurisdiction). Over the first seven years of this period the annual average number of acres added was 104,205; over the next seven years the yearly average number of acres added was 235,931; and over the last seven years, NWRS additions averaged 395,196 acres annually. About 40 percent of these additions came in the form of purchases or donations; another 16 percent came as leases or easements.

Of the lands added to the NWRS over the last 20 years, relatively little (4.5 percent or 229,738 acres) has been for ESA purposes. More revealing is that, of the 1.75 million acres purchased for addition to the NWRS under all available statutory authorities, only 13 percent were purchased under the authority of the ESA. In addition, unlike the overall rate of acquisition, the rate at which these ESA

additions were made did not increase from fiscal year 1982 through fiscal year 2002 and averaged only 11 thousand acres per year.

These facts understate the benefits to endangered and threatened species conservation from NWRS additions in the last two decades. In all likelihood, the vast majority of the more than 4.9 million acres added to the NWRS since fiscal year 1981 by authorities other than the ESA is providing benefits for some endangered and threatened species. In addition, although not additions to the NWRS, for nearly a decade ESA authority has been used to provide grants to states and territories for acquisition of lands associated with approved habitat conservation plans for listed, proposed and candidate species. In fiscal year 2002, \$68 million was provided for this imperiled species land acquisition. Nevertheless, it also is apparent that the role of the NWRS in endangered and threatened species conservation could be greatly enhanced by substantially increasing the relatively sparse use of ESA authority to acquire NWRS lands.

Beyond Land Acquisition

Given that greater than 60 percent of species listed under the ESA occur on private lands (Scott et al. 2001), conservation of these lands is essential to conserving these species. Limited resources and opposition by a significant proportion of the public, particularly in the West, will continue to constrain acquisition of private lands for addition to the NWRS and prevent it from becoming a functioning network of fee title lands that meets the needs of imperiled species. Where large ecological reserves have been proposed through fee title acquisition, they often continue to create more animosity than protected lands. Nevertheless, NWRS land acquisition is often the catalyst that stimulates larger conservation initiatives in a given landscape or the critical element needed to cement related conservation efforts. It frequently coalesces many governmental and private partners for the comprehensive protection of entire systems.

There is considerable value in determining the objective of our land conservation efforts. Is the acquisition of complete authority over specific parcels necessary to achieve endangered and threatened species objectives? Are there objectives for these species, such as population or habitat goals, that can be met as effectively, or more effectively, by other means, such as keeping the land in ranching or forestry? Often the broad, long-term view argues against efforts to

exert absolute control over the landscape and for alternative approaches of working effectively with private landowners. This fact has not gone unrecognized by the Service. On average over the past two decades, approximately 40 thousand acres has been added to the NWRS through leases or easements.

In order to achieve wide-ranging objectives of conserving watersheds, habitat types or ecosystems to maintain biological diversity and to recover endangered and threatened species, many people representing a broad array of interests must identify what needs to be done and consider how it might be accomplished. The Silvio O. Conte National Fish and Wildlife Refuge is a good case in point for the latter approach. It seeks to conserve the natural resources of the 7.2 million-acre Connecticut River Watershed largely by involving the public, especially landowners and land managers, in environmental education programs and cooperative management projects. Fostering partnerships among public agencies, conservation organizations and private landowners continues to be one of the most successful models for encouraging private lands conservation, as evidenced by the North American Waterfowl Management Plan and the Service's Partners for Fish and Wildlife Program.

To achieve the land conservation necessary to recover endangered and threatened species, use of the myriad of available conservation programs, including programs to acquire and manage NWRS lands, must be integrated and that effort brought to bear on the habitats upon which these imperiled species depend. It means that, as noted earlier, research, monitoring and management on NWRS units related to imperiled species must be integrated with ESA recovery planning. It means that the LAPS needs to reflect better the requirements of the ESA to facilitate achieving the goals of that statute, which take precedence over the Service's other responsibilities.

There is not likely to be a single, comprehensive approach or program to conserve endangered and threatened species or biological integrity. Congressional representatives and those in the executive branch think in terms of specific programs and constituencies. They create programs to establish a NWRS, to recover endangered and threatened species, to conserve North American wetlands and migratory birds, to promote conservation practices on agricultural lands, and to acquire and manage national forests, public lands and national parks. These programs are never comprehensive and rarely integrated, and they often conflict because of the manner in which congressional committees and executive branch agencies operate and are organized. Whether in Congress

or in the executive branch, it is easier and more rewarding to create a new program than it is to integrate an existing program.

The reality of independently-created programs makes the job of habitat conservation for endangered and threatened species, as well as other species, much more challenging. It means that habitats for species conservation need to be identified and prioritized. All of the available programs to achieve that conservation also must be identified. Most importantly, implementation of these programs must be integrated and coordinated with one another to achieve the desired conservation result within the landscape in question.

Given greater resources, there is a need and opportunity for the NWRS to play a central role not only in identifying and prioritizing lands for acquisition and managing those lands for conservation purposes, but in serving as a resource for other landowners. The NWRS could, by means of example and management demonstration, play a greater role as a catalyst for improved management on other lands. The NWRS could make a greater effort to integrate its activities with those of other federal and nonfederal landowners and with regional land conservation efforts. All of these actions could elevate substantially the already important role that the NWRS plays in the conservation of endangered and threatened species.

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The National Wildlife Refuge System: A Century of Conservation, Realizing the Enduring Values of National Wildlife Refuges

J. Michael Nussman

American Sportfishing Association

Alexandria, Virginia

The American Sportfishing Association is honored to be a part of the Wildlife Management Institute's special recognition for the National Wildlife Refuge System during this important annual gathering of conservation leaders and this shared celebration for such a momentous occasion in conservation history. The American Sportfishing Association brings a unique perspective from the business community, as a long-standing partner with the U.S. Fish and Wildlife Service and the National Wildlife Refuge System.

The American Sportfishing Association is the leading recreational fishing trade association. We represent 500 sportfishing companies from across the country that contribute to a \$116 billion per year impact on the nation's economy. But we're different from a lot of other trade associations. We work shoulder to shoulder with conservation and recreation groups in the nation's capital, as well as state fish and wildlife agencies and federal land management agencies, such as the U.S. Fish and Wildlife Service.

Because the enduring tradition of fishing depends so much upon the conservation of our lands and waters, we consider our partnerships with the conservation community paramount to our success in safeguarding fishing's future. Equally important, access to fishing areas is a growing obstacle across the country, making refuges and other public lands even more valuable in the future. Like the U.S. Fish and Wildlife Service, we share the view that traditional recreation instills the values that ensure the future conservation of the outdoors.

Because of our link to the sportfishing industry, we're in a unique position to unite businesses with conservation and recreation causes. We do this every day. In addition to our members' advocacy of policies with states and on Capitol Hill, we bring the sportfishing industry to bear on grassroots efforts through our two nonprofit foundations.

The FishAmerica Foundation, our conservation and research arm, gives nearly \$1 million in grants each year to community groups to restore fish and their

habitat. Much of that money comes from creative fund-raising on the part of industry supporters. We're proud of the FishAmerica Foundation, which celebrates its 20th anniversary this year, because we like to think we're promoting conservation by empowering citizen conservationists in their own communities.

Our Future Fisherman Foundation unites the sportfishing industry with a national network of outdoor state educators, national conservation groups and youth groups such as 4-H. Through this network, we offer fishing education programs that provide long-term mentoring and build strong conservation ethics. The sportfishing industry equips thousands of civic groups, camps and public schools with fishing gear for these programs in their communities.

These links offer a lot of potential for the National Wildlife Refuge System in its new century. A wonderful example of innovative partnering is Bass Pro Shops' special catalogue and in-store promotions, featuring refuges, reaching millions of anglers with the message that refuges offer some of the finest fishing in the land.

Another long-standing refuge partner is ESPN, which now owns the 650,000-member Bass Anglers Sportsman's Society. ESPN created a series of special-feature segments about refuge recreation, which have been running throughout this centennial year. Imagine the rallying power we could create if we combined these kinds of promotional partnerships with our efforts with state agencies to promote National Fishing and Boating Week. We'd really be getting the message out about free fishing days, the 263 refuges and other public lands that offer premier fishing opportunities.

As fertile ground for powerful partnerships, refuges offer immeasurable possibilities. With support from the sportfishing industry, we could work together to create fishing tackle loan programs on refuges that offer fishing. We could be backed by major retailers and cataloguers to start a special grants initiative through the FishAmerica Foundation for conservation projects that support refuge fishing. We could provide fishing education programs, training and equipment for environmental educators on refuges. The possibilities are endless because we have so many ties, and there are so many advantages to working together.

That same nexus can help us to find new routes to make more progress for conservation on the National Wildlife Refuge System. Refuges really showcase collaborative conservation, and they can be the cornerstones for future landscape-level approaches, particularly because of their relationship to key watersheds and coastal areas.

Places like Klamath Basin in northern California, Loxahatchee in the heart of Florida's Everglades and many refuges along the Mississippi River, are good examples of the especially challenging scenarios we face today. The issues stretch far beyond refuge boundaries and involve many competing interests.

In many cases, refuge neighbors, recreationists, local businesses and community groups are at the forefront of innovative approaches to conservation. The tremendous growth of 230 refuge support groups and 34,000 volunteers in communities across the country is a wonderful conservation success story, and a testament to refuges' broad appeal among North American citizens. There is more potential to bring businesses into the mix. Gary Loomis, well-known creator of G. Loomis fishing rods, leads a grassroots river restoration program for salmon in the Northwest called Fish First. He not only knows the fishing business, but he also knows about the habitat needs of fish and how to bring people together to make progress. Prominent sportfishing companies, like Zebco and Mercury Marine, launched our FishAmerica Foundation Conservation Grants Program and have been among its strongest supporters. Big manufacturers, such as Pure Fishing, even have their own conservation departments. These are just a few examples of the sportfishing industry's commitment to conservation.

Collaborative conservation is the real spirit of the National Wildlife Refuge System Improvement Act of 1997, in addition to elevating the importance of outdoor recreation on refuges. Comprehensive conservation planning, for example, clearly requires considerations beyond refuge boundaries and fundamentally calls for the involvement of neighbors and partners in refuge management. It's the same kind of empowering approach we support through the FishAmerica Foundation and in our advocacy for the Fishable Waters Act that would boost the Clean Water Act's provisions for healthy waterways. This is good government that should not just represent our interests, but it should design approaches that allow us to be active in protecting our interests.

That brings me to another perspective as an external partner, an organization outside the government. From our standpoint, looking at the big picture for fisheries conservation, it's like looking at disparate pieces of a puzzle, except that we know all the pieces aren't there yet. If we want to start a strong national conservation initiative for fisheries, we first need to know what's going on with the fish. No organization alone can give that kind of fundamental assessment, so the conservation community must consolidate this information and then decide how best to integrate all our efforts.

Consider the myriad groups involved with fisheries conservation. In the federal government alone. There's the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, the Bureau of Reclamation, the U.S. Forest Service, the U.S. National Park Service, the U.S. Bureau of Land Management, the U.S. Army Corps of Engineers and the U.S. Department of Defense. State fish and wildlife agencies, regional fisheries commissions, and Native American tribes are certainly treasure troves of information about fisheries. Then, there are private organizations like the American Fisheries Society, Trout Unlimited and the Bass Anglers Sportsman's Society. We need to find new ways to energize the fisheries community to integrate information about the status of fisheries, and we need to find comprehensive approaches to conservation that include benchmarks to evaluate our progress.

The National Wildlife Refuge System probably is not in a position to take charge of such an effort, but refuges are successful at bringing people and groups together in a lot of different arenas. Because of its unique role in the federal family of public lands, perhaps the refuge system could help unite public land and water management agencies when it comes to fisheries conservation, which would be a great start. It behooves all of us involved with fisheries conservation to recognize what we're up against. To make the most progress for fish, we need a coordinated effort to guide us.

There is a promising thing about the U.S. Fish and Wildlife Service's Partnership Agenda for Fisheries Conservation. The Sport Fishing and Boating Partnership Council got a committed group of key players from the industry, states, tribes, federal agencies and conservation organizations together. This group decided that a collaborative, grassroots approach to conservation, supported by state and federal governments, could make a difference for fish nationwide, much like the North American Waterfowl Management Plan has done for ducks. The National Wildlife Refuge System is in a great position to serve as a catalyst by endorsing and participating in this joint venture concept, just as it has under the North American plan.

The evolution of the National Wildlife Refuge System can also be an important model for some of the larger conservation movements we're seeing today, especially in regard to marine conservation. Over the last several years, anglers and other conservationists have made a lot of headway in raising awareness of ocean conservation issues, and, if past is truly prologue, what's unfolding is a movement for an ocean ethic much like the land ethic that inspired by Aldo Leopold and other pioneers during the 20th century.

Landmark laws like the Magnuson Fishery Management and Conservation Act are a pivotal part of this. The 1996 amendments to this law were the first to require effective standards and benchmarks for monitoring our progress in restoring ocean fisheries, and the fact that this just happened a few years ago shows how far behind we are when it comes to ocean conservation. Another significant ocean issue is the growing push for a national network of marine protected areas. That's where the lessons we've learned from the National Wildlife Refuge System could really be relevant.

There were a lot of different impetuses behind the expansion of the refuge system. Theodore Roosevelt's love of hunting fueled his establishment of our big game refuges, refuge pioneers reacted to the devastating drought conditions by protecting the prairie potholes, and laws—like the Endangered Species Act—led to approximately 60 refuges that protect rare species. After 94 years of operating under differing mandates without global guidance, leaders in the U.S. Department of the Interior, the conservation community and Congress finally got the refuge system what it needed most: clear definition and comprehensive guidance in the form of the National Wildlife Refuge System Improvement Act.

The same thing is happening with protected marine areas, but we have time and 20/20 hindsight on our side to make different choices about our approaches to conserve ocean habitats. Right now, there are a half-dozen different types of marine sanctuary designations, and there are probably three times as many interpretations of what a protected marine area should be. They are often established without defined conservation goals, effective monitoring guidelines or benchmarks to mark progress in conserving these areas.

Unfortunately, the fervor to establish protected marine areas is overtaking common sense about public involvement in decision-making and access to these areas. We would like to work with our conservation partners to hammer out federal legislation providing better guidance for establishing and conserving protected marine areas. But, the approach we advocate is based on conservation needs established by sound science, and we would not exclude public access or recreation unless it is warranted by those needs. This is no different from the conservation approaches on refuges and even wilderness areas.

That points to what we can learn from the National Wildlife Refuge System Improvement Act. While it makes conservation primary, it does not

exclude recreation on refuges. In fact, it encourages it when it's compatible with wildlife conservation. The law clearly acknowledges that one of the main reasons we conserve natural resources is to ensure that North American citizens can continue to enjoy them through outdoor recreation. The law recognizes that conservation and recreation can go hand in hand in the majority of cases. When fisheries are in trouble, anglers are the first to sacrifice their catch or technique to help solve the problem. They've been at the forefront of recovery for striped bass, redbfish and white sea bass, to name only a few.

Through all its provisions for public involvement and partnerships, the National Wildlife Refuge System Improvement Act also inherently recognizes, in the true spirit of conservation, that people are a part of the conservation equation. That will be even more of a reality in the 21st century than it was in the 20th. People value what is relevant to them, and outdoor recreation such as fishing, makes conservation directly relevant to tens of millions of North Americans.

People will be the key to realizing the enduring values of the National Wildlife Refuge System. The fish and wildlife knew how important their habitat was long before we came around, and they don't need the kind of evidence that we do. As the National Wildlife Refuge System turns the corner on a new century of conservation, it is fortunate to have such a direct link to fundamental things our society cares about: open spaces, clean water and air and the scenic getaways that offer countless wonders to rejuvenate us from the hustle and bustle of our daily living.

The American Sportfishing Association is proud to be a long-standing partner with the U.S. Fish and Wildlife Service and the National Wildlife Refuge System. What the agency does for fisheries and the great sport of fishing enriches our lives and the North American way of life. We can never measure the value of the experiences refuges offer through fishing, nor can we imagine how many lasting memories those experiences give 6 million anglers every year. That's why we're a proud member of the Cooperative Alliance for Refuge Enhancement, the group of 20 conservation organizations that join forces to advocate for strong investments in the National Wildlife Refuge System. It's wonderful to be a part of this coalition that makes such a difference for refuges, as the historic funding increases of recent years clearly show.

The American Sportfishing Association is grateful for this opportunity to thank the Wildlife Management Institute and the U.S. Fish and Wildlife Service. Partnerships are more than just sharing resources. They're about sharing

perspectives. When we get outside ourselves, when we step outside the day-to-day trenches of our specific efforts, we can see the larger trends that affect all of us in the conservation and recreation community. Then, we get a better sense of the common interests we share and the new links we can make to protect the outdoors. This is how we find new avenues to make progress together.

State Fish and Wildlife Agency Perspectives on National Wildlife Refuge Planning Issues and Development of Policies Pursuant to the National Wildlife Refuge System Improvement Act of 1997

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The International Association of Fish and Wildlife Agencies

The International Association of Fish and Wildlife Agencies (Association) includes among its members the state, federal and provincial fish and wildlife agencies in North America that are charged with ensuring the conservation of fish and wildlife resources for the benefit of our citizens. Established in 1902, the Association represents the collective interests of the 50 state fish and wildlife agencies (states) before Congress and the executive branch agencies. The federal fish and wildlife and land management agencies are also members of the Association, as are the federal and provincial fish and wildlife agencies of Canada and Mexico. The Association's goal is to promote sound land and resource management and strengthen federal, state and private cooperation to ensure the vitality and sustainability of fish and wildlife resources for the use and enjoyment of all of our citizens.

During the last several years, the Association and the states have worked sincerely and assiduously to establish meaningful involvement of the states by the U.S. Fish and Wildlife Service (Service) on national wildlife refuge planning issues and development of policies pursuant to the National Wildlife Refuge System Improvement Act of 1997 (Improvement Act).

The State Fish and Wildlife Agency Mission

Fish and wildlife are truly public resources, and the states are public trustees of these resources, with statutory (and, in some cases, constitutional) responsibility for ensuring their conservation for all citizens. In the case of

migratory birds, threatened and endangered species, and anadromous fish, Congress has given the federal agencies certain conservation responsibilities, and the states share jurisdiction with the federal government for these species. However, the states remain the principal authority for fish and wildlife within their borders, even on most federal public lands. This jurisdictional relationship is reflected in several federal statutes concerning fish and wildlife conservation and federal public land management, including the National Wildlife Refuge Administration Act as amended by the Improvement Act.

The National Wildlife Refuge System Improvement Act of 1997

The Association and the states have a long-standing interest and involvement in the National Wildlife Refuge System (Refuge System) and were instrumental in the deliberations leading to the passage of the Improvement Act. The Improvement Act, completed after years of bipartisan discussion and deliberation, truly represents a benchmark in the history of the Refuge System. It established a statutory mission of the Refuge System to administer a national network of lands and waters for the conservation, management and, where appropriate, restoration of fish and wildlife and their habitats. With the Improvement Act, Congress reaffirmed that national wildlife refuges are for fish and wildlife conservation first, clearly setting them apart from other federal public lands. In addition, Congress directed the Service that compatible wildlife dependent recreational uses are the priority general public uses of the Refuge System and shall receive priority consideration in refuge planning and management. No less important is Congress' direction to the Service to effectively coordinate management of fish and wildlife within the Refuge System with the states. This legislated coordination is good for fish and wildlife resources and for citizens.

Development of Refuge Policies in Accordance with the Improvement Act

The Service finalized the Compatibility and Comprehensive Conservation Planning Rules in 2000 after a period of public review. In 2001, the Service finalized the policy, *Maintaining Biological Integrity, Diversity, and Environmental Health*. The states, individually and collectively, through the

Association, submitted extensive comments on these policies, but they were not satisfied that the final rules and policy were adequately responsive to the states' concerns, particularly in light of congressionally-directed coordination with the states on refuge management. Subsequently, several state agencies requested that the Service republish these final policies for further review. This makes particularly good sense as the drafting of subsequent policies has pointed out the need for examining the interrelationship of all of these refuge system policies. A decision on this request is still pending by the Service.

In January 2001, the Service published the following draft policies for public review and comment: *National Wildlife Refuge System Mission, Goals, and Purposes*; *Appropriate Refuge Uses*; *Wildlife-Dependent Recreational Uses (Hunting, Fishing, Wildlife Observation and Photography, and Environmental Education and Interpretation)*; and *Wilderness Stewardship*. The states developed extensive comments and met several times with the Service to discuss and resolve specific issues regarding these policies. Initially, the Service appeared unwilling to make meaningful changes to the policies that would be responsive to states' concerns. This led the states to question the Service's commitment to the direction in the Improvement Act to work cooperatively, in a meaningful way, with the states to develop refuge policies.

A New Approach to Refuge Policy Development

The states, along with the Service and (under certain circumstances) the Native American tribes, are the only entities in the United States with legal authority for fish and wildlife conservation. The states are not nongovernmental organizations (NGOs). One of the states' most significant concerns has been that the Service coordinates with the states at the same time as they coordinate and discuss issues with the NGOs and the public, and this coordination with the states has not always been meaningful. The states firmly hold that, because of statutory responsibilities for fish and wildlife management, the Service should have a government to government relationship with the states.

In May 2002, the Service and the states agreed on a mechanism to fully engage the states in the development of the draft refuge policies in a way that is consistent with our conservation responsibilities. Five state fish and wildlife agencies (Alaska, Montana, Arizona, South Carolina and New York), as a workgroup representing all of the states, entered into Intergovernmental

Personnel Act (IPA) agreements with the Service. In addition to continuing our work on the draft policies, the states further requested that the Service provide specific internal direction to staff that clarifies the states' role in the management of fish and wildlife populations on refuges. The states requested that this direction be incorporated into each new policy and communicated through a Service director's order. In December 2002, Director Steve Williams released a director's order that addresses state and federal relationships, responsibilities and procedures the Service will follow when developing policy for and managing the Refuge System. This guidance has been sent to the Service's regional directors and their refuge staff with the clear expectation that early and close coordination and cooperation with states will be the standard for managing refuges. The director's order reaffirms that both the Service and the states have authority and responsibility for management of fish and wildlife on refuges. With implementation of the director's order, the Service and states can most effectively complement our responsibilities for the conservation of fish and wildlife and their habitats on refuges. The director's order will be in effect until a permanent policy can be published in the Federal Register.

Since the release of the director's order in December 2002, the IPA team continues to work on the draft policies. We completed the *Mission, Goals and Purposes Policy and Appropriate Refuge Uses Policy*, and we have nearly completed the *Wildlife-Dependent Recreational Uses Policy*. The team will also reinitiate work on the *Wilderness Stewardship Policy* in 2003, which remains complicated and, thus far, has escaped reconciliation between the Service and states.

Long-term Challenges—State and Federal Cooperation in Refuge Management

The Service's recent action to involve the states in the development of refuge policies as a true statutory partner through IPA agreements clearly demonstrates a welcome approach to refuge policy development that is consistent with the Improvement Act. This approach, and the guidance provided through the new director's order, sends a strong message to the states that the Service is truly committed to the Improvement Act and working cooperatively with the states to conserve and enhance fish and wildlife populations and their habitats on refuges. The states are likewise committed to making this happen.

This new way of doing business provides the states with opportunities to overcome some very difficult challenges in our efforts to develop refuge policies and plans that both the Service and the states can support. These challenges include: establishing and maintaining trust relationships and strong partnerships necessary to effectively develop refuge policies and manage fish and wildlife populations and their habitats on refuges; minimizing the state and federal jurisdictional debates that delay the development of policy and delay cooperative work at the local level on refuge plans and projects; developing and implementing refuge policies, management plans and projects that support individual refuge purposes; and ensuring the application of professional (not personal) philosophies to refuge planning processes (i.e., development of policies and comprehensive conservation plans), particularly with respect to hunting, fishing and implementing proactive fish and wildlife conservation projects within refuge wilderness areas.

Establishing Trust Relationships and Strong Partnerships

The 2002 director's order guides the Service's region and refuge staff regarding state and federal relationships and procedures that will be followed when developing policy and managing the Refuge System. With this director's order, the Service communicated a clear expectation that early and close coordination and cooperation with the states will be the standard for managing refuges. This standard, along with a strong commitment from the states, demonstrates the new approach to refuge policy and plan development. In order for this approach to be successful, however, the Service and states, at all levels, must be committed to building trust relationships and strong partnerships. Successful state and federal partnerships, and there are many, can be found in those states, regions and refuges where our agencies have taken the time to develop relationships and meaningful partnerships. Conversely, state and federal agency conflicts and significant delays in the development and implementation of refuge plans and projects occur in those states, regions and refuges where our agencies are spending more time focusing on their disagreements than to developing relationships and working cooperatively to effectively manage refuges. The states and the Service need to work together to complement both agencies' responsibilities for the conservation of fish and wildlife resources on refuges. Time spent developing good fundamental relationships between our agencies is time very well spent.

Eliminating the State and Federal Jurisdictional Debates

The states and the Service need to move beyond the ongoing jurisdictional debates and focus on working cooperatively to develop sound fish and wildlife conservation plans and projects. Refuge planning efforts in some states have been delayed for several years because agencies can't move beyond the debate regarding which agency calls the shots. At least, there needs to be a commitment between the agencies that, if differences can't be resolved at the refuge level, then they will be elevated through the chain of command to facilitate resolution. The ongoing jurisdictional debates and associated delays in the development of conservation plans and projects, on some refuges, do not put fish and wildlife conservation first. Again, the Service and the states must work together to complement our agencies' responsibilities for the conservation of fish and wildlife resources on refuges.

Refuge Policies, Plans and Projects That Support Refuge Purposes

Most refuges were established for specific fish and wildlife conservation purposes. The Improvement Act requires that each refuge be managed to fulfill the Refuge System's mission and the specific purpose(s) for which the refuge was established. However, managing some refuges to fulfill specific purposes (e.g., conservation and management of bighorn sheep) can be complicated and (in some cases) compromised by other refuge purposes and land designations (e.g., refuge wilderness designation). As we move forward with the new approach to refuge policy and plan development, the states will work cooperatively but aggressively to ensure development and implementation of projects that are necessary to maintain the purpose(s) for which the refuge was established. Fulfilling the Refuge System mission and refuge purpose(s) will involve appropriate fish and wildlife conservation projects in refuge wilderness areas that need to be supported collectively by both the Service and the states.

Hunting, Fishing and Management within Refuge Wilderness Areas

The overlay of wilderness policy and philosophy on management of refuges, in the West in particular, is of continuing significant concern to the states. Fish and wildlife populations represent important wilderness resources, and these resources must come first on refuges, consistent—in our opinion—with the Improvement Act. Maintaining and enhancing fish and wildlife resources on refuges in a way that is consistent with refuge purposes and the Improvement Act

often will involve active management within refuge wilderness areas. The states believe that it is inconsistent with the Improvement Act to establish refuge wilderness policy and try to make refuges fit into that policy. Through the Improvement Act, Congress directed the Service to conserve fish and wildlife resources for the benefit of present and future citizens. Wilderness purposes should be considered along with other refuge purposes, and they should not trump the mission, purposes and goals. Instead, they need to be consistent with them. Moving important wildlife projects off of refuges, due to wilderness designation, is not consistent with putting fish and wildlife conservation first.

Refuge wilderness policy and philosophy are causing significant delays in some refuge planning efforts. In some western states, wilderness policy has precluded discussions regarding necessary fish and wildlife habitat conservation projects and, in some cases, expansion of hunting opportunities on refuges. Fish and wildlife populations are important components of wilderness and, on refuge wilderness areas, the states believe that management can continue to fulfill specific fish and wildlife conservation purposes while also maintaining wilderness act purposes. Fish and wildlife conservation and wilderness management on refuges do not have to be incompatible with one another. Again, however, wilderness purposes should not trump the Service's mission and the Improvement Act. The states maintain that the wilderness acts do not prohibit fish and wildlife conservation within refuge wilderness areas, and we will continue to seek development of a wilderness stewardship policy that is consistent with the Improvement Act and the agencies' missions.

The States' Perspectives on the Improvement Act, Policies and Plans

During the last several years, the states and the Service have made significant progress toward working cooperatively on policies and guidelines and managing the Refuge System. Although this work is extremely time-consuming and, at times, frustrating, the states are confident that this revitalized partnership is critical for the conservation of fish and wildlife resources on refuges. The states have embraced the opportunity to be directly involved in the development of refuge policies, and there is good progress to report. The Service's willingness to involve the states in the development of refuge policies, as a true statutory partner through IPA agreements, demonstrates a welcome approach to policy development that is consistent with the Improvement Act and the states'

expectations. Through the 2002 director's order, the Service sent a very strong message that it is committed to working cooperatively with the states. The Service recognizes that the states have authority and responsibility for the management of fish and wildlife populations on refuges. The agencies have developed procedures for working together on refuge policies and plans and reaffirmed our expectations that early and close coordination and cooperation will be the standard for managing refuges. This approach to refuge policy and plan development represents a major success story. The states are committed to this approach and are working cooperatively with the Service to develop policies and plans that both agencies can support. Our fish and wildlife resources and our nation's citizens deserve nothing less.

The Role of the National Wildlife Refuge System in Conserving Biodiversity: Existing Challenges and Future Needs

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The Nature Conservancy (Conservancy) is an international, nonprofit organization, dedicated to the conservation of biological diversity. Our mission is to preserve the plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive. The Conservancy has more than 1,000,000 individual members and 1,900 corporate associates. We currently have programs in the 50 U.S. states and in 30 countries. To date, we have protected nearly 15 million acres in the United States and Canada, and we have helped local partner organizations preserve over 83 million acres overseas. The Conservancy owns and manages 1,340 preserves throughout the United States—the largest private system of nature sanctuaries in the world. Sound science and strong partnerships with public and private landowners for tangible and lasting results characterize our conservation programs.

The United States Fish and Wildlife Service's (Service's) mission is to work with others to conserve, protect and enhance fish, wildlife and plants and their habitats for the continuing benefit of the North American people. The Service meets its mission through a variety of methods, including its administration of the Dingell-Johnson funds, Pittman-Robertson funds, Migratory Bird Conservation Act, North American Wetlands Conservation Act, Endangered Species Act and private landowner incentive programs, such as Partners for Fish and Wildlife. Perhaps the best known and most visible expression of the Service's mission is the National Wildlife Refuge System (System). The System consists of 540 refuges, comprising more than 94 million acres in each of the U.S. states and numerous U.S. territories.

The mission of the System is, “to administer a national network of lands and waters for the conservation, management and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans” (105th Congress 1997). The Secretary of the Department of the Interior is required to, “ensure that the biological integrity, diversity, and environmental health of the System are maintained for the benefit of present and future generations of Americans” (105th Congress 1997).

This similarity of missions between the Conservancy and the Service has fostered one of the Conservancy’s most significant conservation partnerships. One of the Conservancy’s best known conservation strategies is the acquisition and protection of biologically important lands and waters. Since 1967, the Conservancy has completed 1,173 real estate transactions with the Service, resulting in the transfer of 1,504,515 acres that are valued at \$544,45 million to the Service. Approximately 100 national wildlife refuges (NWRs) have been established or enlarged because of these transactions, including Alligator River NWR (North Carolina), Sevilleta NWR (New Mexico), St. Vincent NWR (Florida), Chickasaw NWR (Tennessee), Arkansas NWR (Texas), Great Dismal Swamp NWR (Virginia), Ash Meadows NWR (Nevada), Balcones NWR (Texas), Canyonlands NWR (Texas), Blackwater NWR (Maryland) and ACE Basin NWR (South Carolina). Some of the Conservancy’s current refuge projects include Cache River NWR (Arkansas), National Key Deer NWR (Florida), Cahaba River NWR (Alabama), Cat Island NWR (Louisiana), Red Rock Lakes NWR (Montana) and the soon to be established Baca NWR (Colorado).

To succeed, the Conservancy implemented a framework in the 1990s. We call this framework for mission success Conservation by Design. This framework gives the Conservancy’s broadly stated mission purpose and direction—a compass bearing to align the organization with effective conservation action to achieve tangible, lasting results. It sets forth:

- a clear, concise vision for accomplishing mission success
- an ambitious goal for the year 2010 to make the necessary progress toward fulfilling this vision
- an overview of our integrated approach for achieving this goal
- an outline of the measures we use to monitor our organizational progress
- a description of the unique values that characterizes the Conservancy’s conservation work.

Through this approach, we harness the innovative and enterprising spirit that is the hallmark of the Conservancy. With each of our local, state and country programs acting on a shared understanding of what constitutes success, we work as one organization, one Conservancy, while taking full advantage of our decentralized organizational structure. The Conservancy's staff hold themselves accountable to this framework.

The reasons for developing and instituting Conservation by Design included a recognition that our core strategy of purchasing land for conservation ownership was inadequate to meet the challenges of protecting biodiversity, that we were not utilizing the best available science to the fullest extent possible, that meeting the costs of operations and maintenance for a system of preserves was not the most leveraged use of our charitable dollars and that we needed to be more creative and flexible in achieving our conservation goals. Many of these same issues challenge the leadership and staff of the System.

There are four fundamental components to the Conservancy's integrated conservation process:

- setting priorities through ecoregional planning
- developing strategies to conserve both single and multiple conservation areas
- taking direct conservation action
- measuring conservation success.

It is through this approach that the Conservancy anticipates achieving its 2010 goal of conserving 500 functional landscapes and 2000 other functional conservation areas in the United States (The Nature Conservancy 2000). More information on Conservation by Design is available at our website, <http://www.nature.org>.

A key activity in our conservation process is the development of ecoregional plans. In fact, the plans are closer to biological assessments; they identify a portfolio of conservation areas and ecological targets within an ecoregion that, if conserved, would protect the full range of biodiversity within that ecoregion. The identification of these portfolio sites—in essence, a blueprint for conservation action—is the platform for our conservation work.

Planning for the Refuge System to Achieve Biodiversity Conservation

The need for a strategic plan to guide the growth of the System is obvious to the Service, its partners and Congress. It has been, perhaps, too easy to create

refuges in recent years. Congress created multiple authorities to establish refuges, and they have been used. There are also significant and legitimate concerns raised by congressional appropriations subcommittees, conservation organizations and the Administration over the ongoing (and deferred) costs of operations and maintenance.

The existing de facto moratorium on the expansion or creation of new units through administrative action, however, threatens to cause the loss of important conservation opportunities. Although it is appropriate, necessary and legislatively required for the Service to create its own strategy for growing the System, it needs to recognize its critical and continuing role in acquiring and managing nationally significant fish and wildlife habitat. If the Service does not expand and create refuges—in part, responding to the dynamics of significant conservation real estate opportunities—then Congress can respond to these conservation opportunities by legislatively expanding boundaries and establishing new refuges. The longer the Service does not complete and explain a robust and well-conceived planning process to Congress, its partners and its constituents, the more Congress can be expected to step in to direct, on an ad hoc basis, the future growth of the System. This could have negative consequences for the System, including the acquisition of lands better suited for other conservation management, but whose long-term operations and maintenance costs will be borne by the Service.

During a time of constrained federal budgets and legitimate questions concerning the growth of the System, serious attention must be given to the size of the System and its role in conserving biodiversity. The System will never conserve the nation's biodiversity by itself; however, it is now and will continue to be an important part of conserving nationally significant natural areas. The Conservancy believes that the science-based approach within Conservation by Design can assist the Service in its design of new and expanded refuges.

The issues concerning the growth and financing of the System are of great current concern; they have also been the subject of serious discussion for decades. The following statements, each of which remain an issue today, were taken from the *National Wildlife Refuge System Report of the Advisory Committee on Wildlife Management to U.S. Department of the Interior Secretary, Stewart Udall* (Leopold et al. 1968), concerning the System:

- “Some difficult questions, raised by Congress and the General Accounting Office are: When will the federal refuge system be

complete? How much more land is needed? How much more money will it cost?”

- “But the process of refuge expansion should be subject to orderly planning, leading ultimately to a more or less stabilized network of management units.”
- “We recommend continuing appraisal of the existing refuge system, with a view to perfecting the long-range plans for land acquisition and development. The national refuges constitute an open-ended system and units will doubtless be added and others deleted indefinitely into the future. But these adjustments should allow a systematic procedure aimed at satisfying firmly defined goals” (Leopold et al. 1968).

More recently, in the 1998 Service publication, *Biological Needs Assessments*, one of the stated goals for the System was to, “focus biological activities through goals and objectives.” More specifically, the report states: “The lack of clear and consistent goals and objectives at National and Regional levels makes it impossible to plan refuge activities across the System that consistently support critical resource needs of the larger landscape. Locally focused goals and objectives, or others that are out of date or lacking, make it difficult to direct and evaluate station biological activities for the greater good”

The 1998 report concludes: “without clearly articulated biological goals and objectives at all levels, it becomes difficult to defend controversial actions before a questioning public, defend budget requests, or to promote educated advocacy for the biological integrity of either the station or the System .”

As the Service plans for the future of the System, the issues of growth and financing of the System continue to be of concern to Congress and the constituency of the System. A well-designed, strategic, national, planning effort that is science-based will answer many of these concerns. Such a planning effort should incorporate short- and long-term quantifiable measures of success, and it should incorporate a deliberative process for adding, expanding and, perhaps, deleting units of the System, along with an associated budget to achieve the goals of the plan.

Perhaps most significantly, the Service and the future System must continue to be flexible and creative in the design of tools and approaches to achieve its mission. One example of innovation was the creation of the Silvio O. Conte National Fish and Wildlife Refuge (Conte Refuge) in 1991. This is not an

ordinary refuge. The Connecticut River watershed, 7.2 million acres in four states, is larger and more heavily populated than areas usually considered when creating a refuge. The purposes of the refuge are also much broader than usual. Recognizing that land acquisition alone cannot meet this challenge, the Conte Refuge's primary action is to involve the people of the watershed, especially landowners and land managers, in cooperative management projects and environmental education programs. The Conte Refuge is an important laboratory from which lessons will be learned to guide new refuges and their refuge managers in the future (U.S. Department of the Interior, Fish and Wildlife Service, Silvio O. Conte National Fish and Wildlife Refuge 2003).

There are multiple examples of other innovative conservation strategies that are now being implemented throughout the System. In recent years, the Service, the Conservancy and private landowners have made significant conservation investments that have conserved both biodiversity and the ranching economy of Montana's Centennial Valley. Twenty miles west of Yellowstone National Park, is an undeveloped, high, river valley, which provides habitat for grizzly bears, wolves, wolverines and lynxes, called the Red Rocks National Wildlife Refuge. It protects portions of the largest valley wetland complex in the Greater Yellowstone Ecosystem. Since fiscal year 2002, Congress has appropriated \$4.75 million from the Land and Water Conservation Fund to acquire conservation easements on private lands outside the refuge boundaries. The Conservancy has also purchased easements and received donated easements from local ranchers. The Service's investment in the Centennial Valley represents a public-private partnership that promotes conservation and helps to support the local ranching economy. We hope that the Service will soon approve a similar project to purchase conservation easements on Montana's Rocky Mountain front.

The Northern Tallgrass Prairie NWR, in Minnesota and Iowa, is another example of innovative action to conserve biodiversity. Established in 1999, the refuge boundaries include 85 counties in western Minnesota and northern Iowa. The goal of the refuge is to conserve one of the most endangered ecosystems in America: the tallgrass prairie. This ecosystem once covered 25 million acres; less than 1 percent of the original prairie now remains. The goal of the refuge is to preserve 25 percent of the remaining prairie, primarily through conservation easements, in the project area. There are substantial nonfederal conservation investments within this project area, including Minnesota's innovative habitat

corridors initiative and the Conservancy's \$9 million acquisition of the 25,000-acre Glacial Ridge Preserve.

In Louisiana's Red River NWR, the Service is working to acquire and restore rich bottomland hardwood forest habitats. Both the Conservancy and The Conservation Fund are working to restore agricultural fields to forests with the financial assistance of investors seeking carbon credits. In addition, the Army Corps of Engineers is expected to soon utilize its significant mitigation authorities to further the conservation goals of restoring this remarkable area.

One final example of an area where the Conservancy and others believe the Service has a significant role to play is in the lands around Fort Bragg, North Carolina. Perhaps no single military base best exemplifies cooperative conservation to meet the military readiness needs of the U.S. Department of Defense while also ensuring important conservation goals, in this case, the long-term viability of the red-cockaded woodpecker and its long-leaf pine habitat. Beginning in the early 1990s, operations at Fort Bragg were limited by Endangered Species Act litigation, arising from the declining populations of the red-cockaded woodpecker. In a scenario all too common throughout the country, military bases that were established in the early 20th century in remote rural areas are now suffering the consequences of encroaching suburbia. Many of our military bases have become shrinking islands of high-quality natural habitats. Last year, Congress enacted legislation to enable the U.S. Department of Defense to address this problem by entering into contracts with conservation groups and others to acquire buffer lands adjoining existing bases to meet the dual needs of military readiness and environmental protection. The Conservancy is proud of its work with the military, at Fort Bragg and dozens of other bases, to find solutions to these problems. At Fort Bragg, we believe the Secretary of the Army was right last summer when he requested Gale Norton, the Secretary of the U.S. Department of the Interior, to support the establishment of the Southern Pines NWR, adjacent to Fort Bragg.

A lesson that is more timely than ever, is the importance of incorporating the private landowner as a partner to achieve the mission of the System. Secretary Norton deserves credit for her vision of citizen stewards as partners in innovative, cooperative conservation partnerships. Secretary Norton has proposed significant increases for U.S. Department of the Interior programs, including the Service programs Partners for Fish and Wildlife and challenge-cost share, that provide conservation incentives for private land conservation.

In addition, a conservation education plan that would accompany a strategic conservation plan for the System could further public support for the System and the conservation of biodiversity. A significant aspect of the administration of the System, as established in the Refuge Improvement Act of 1997, are six priority general public uses that “shall receive priority consideration in refuge planning and management” (105th Congress 1997). Two of these priorities are environmental education and interpretation. As the System undergoes its strategic planning for new acquisitions, the Service should develop and implement a comprehensive NWR conservation education plan. Such a plan would educate and reinforce to the public that each of the refuge units is part of the larger national network of lands and waters administered for their benefit. This comprehensive conservation education plan for the System could serve a number of other conservation education goals, including, but not limited to, developing a deeper public understanding and appreciation of:

- the concept of biodiversity, the need to conserve it and the strategies and actions to do such
- international conservation agreements and cooperation and their role in conservation, with particular emphasis on migratory species
- state natural resource agency and private landowner partnerships that assist the System in achieving its mission
- the historic and current support role of the consumptive user for the System and the need for broader public support.

State and Tribal Wildlife Grant Program

A historic opportunity is emerging that can enhance significantly our common objective of ensuring the biological integrity and diversity and of the System. In fiscal year 2001, after the unsuccessful legislative effort to enact the Conservation and Reinvestment Act (CARA), one of the benefits that did emerge from the widespread bipartisan effort to increase conservation investments was the creation of the Wildlife Conservation and Restoration Program (WCRP). The WCRP evolved in fiscal year 2002 into the State Wildlife Grants Program, and, in fiscal year 2003, the current State and Tribal Wildlife Grants Program was established. Regardless of the program’s name, a common element is the development of comprehensive wildlife conservation plans for each state, territory and the District of Columbia that accepts funds for wildlife

diversity conservation activities. This planning process enables all state wildlife and natural resource agencies, in full cooperation with their conservation partners, to comprehensively plan for the next generation of conservation.

The comprehensive wildlife conservation planning process is built upon seven well-designed and thoughtful criteria. Guidance from the leadership of the International Association of Fish and Wildlife Agencies (IAFWA) has supplemented these criteria to set the stage for, perhaps, the most ambitious public conservation planning exercise undertaken on a national scale. Of particular note, these criteria and the guidance from the IAFWA stipulate that these plans should not be developed in isolation from one another. The Conservancy's ecoregional plans and associated data can provide a conservation approach that considers biodiversity conservation at an ecoregional landscape scale beyond political boundaries.

Another opportunity to look across state borders in developing these plans may be contained in the Service's recently released report *Birds of Conservation Concern 2002*. This report consists of a series of 45 lists that identify bird species of concern at national, regional and landscape scales and incorporates, among other lists, species lists for each of the 37 Bird Conservation Regions (BCRs) in the United States. The BCR lists can help focus on-the-ground conservation actions on the highest priority bird species (U.S. Department of the Interior 2002).

As states and their conservation partners develop the comprehensive wildlife conservation plans, the Conservancy encourages the addition of a self-imposed eighth criteria: the development of a budget necessary to implement these plans. Such a budget should include potential sources of funding to achieve the plans' conservation goals and objectives. A well-designed budget serves many purposes, including the ability to help measure success, but more importantly, it would make the case for increased public conservation investments, at all levels of government and from private sector partners.

Summary

The Conservancy and the Service have long enjoyed a successful partnership in conserving biodiversity through the System. As we enter the System's 2nd century, the Conservancy looks forward to working with the Service, at all levels of its respective organizations, in its biodiversity conservation planning and its activities.

The emerging opportunities for the conservation community to engage in the state wildlife planning process hold enormous potential to promote biodiversity planning and conservation. The Conservancy looks forward to working closely with the Service, state natural resource agencies and other partners to fully realize this historic opportunity.

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The National Wildlife Refuge System: The Next 100 Years

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Introduction

Aldo Leopold (1949) wrote, “To those devoid of imagination, a blank place on the map is a useless waste; to others, the most valuable part.” He also wrote, “There are some who can live without wild things, and some who cannot.” We believe that, given a choice, few would choose to live without them. A choice has been made for North America, by the will of a free people through the voice of their elected representatives. For 100 years, through crisis or opportunity, the National Wildlife Refuge System (System) has grown and prospered. From a meager beginning of one refuge and five acres in 1903, the System has grown to 540 refuges and over 95 million acres by 2003. The System was born out of a need to protect severely threatened migratory bird populations from market hunting. It began in order to manage dwindling big game populations, then to save

waterfowl from the catastrophic droughts of the Dust Bowl Era. Later the System rose to the focused mandates of endangered species protection and recovery. It took advantage of the desire and opportunity to protect entire ecosystems in Alaska, and it welcomed the emerging goal of protecting the nation's biodiversity. The System now stands as a monument to wildlife conservation, the world's largest system of lands and waters that are dedicated solely to the protection of fish, wildlife and plants.

The System is now home to more than 700 species of birds, 220 species of mammals, 250 species of reptiles and amphibians, and over 200 species of fish. It protects habitat for more than 250 species of threatened and endangered plants and animals. There is at least one refuge in each of the 50 states, and there is one within an hour's drive of most major U.S. cities. Over 40 million people per year visit the System.

As we look forward to the next 100 years of the System, we benefit from the rich history and experience of the System during its first century. This paper looks ahead with hope and promise, knowing that many future changes are beyond our current understanding. It describes management challenges of today and tomorrow, and it outlines cautions to help future managers avoid mistakes of the past.

System Growth

The National Wildlife Refuge System Improvement Act (NWRSIA) of 1997 (Public Law No. 105-57) directs the Secretary of the U.S. Department of the Interior to plan for the continued growth of the System, to accomplish the mission of the System, to conserve ecosystems and to complement the conservation efforts of states and other federal agencies. Refuge lands are acquired through: purchase, exchange or donation of fee title or easement interest; withdrawal from the public domain; leases; cooperative agreements; and transfer from other federal agencies. Except rarely, to clear title or establish legal fair market value, the U.S. Fish and Wildlife Service (FWS) does not use condemnation to acquire refuge lands.

Congress provides money to acquire new lands from two primary sources, the Land and Water Conservation Fund (LWCF), consisting primarily of money from offshore oil and gas lease sales, and the Migratory Bird Conservation Fund (duck stamp monies). Competition among individual refuge

acquisition programs has become acute as land prices increase faster than appropriated funds. In the near term, increased LWCF appropriations for struggling acquisition programs will pay rich, long-term dividends where key pieces of habitat remain unprotected. In the long-run, new sources of acquisition funding will be needed as offshore oil and gas resources are depleted or fall in demand.

There will always be strong opinions about which lands should be added to the System. Internally, we will sometimes debate acquiring what is available, while it is available, regardless of operational funding, versus buying only what we can currently afford to manage. Organizations and individuals will offer to donate property they want to see protected, regardless of the contribution to a national conservation strategy, and others will advocate limits on any expansion of federal land ownership. Most future additions to the System will be smaller than those of the past, and they will be more focused on specific conservation objectives with exceptions. Large new refuges that are surplus to the national defense needs of the 21st century could come from U.S. Department of Defense or the U.S. Department of Energy lands. Or, perhaps the lands will come from large areas of unappropriated federal lands in the West to conserve diminishing species, such as sage grouse (*Centrocercus urophasianus*) and black-tailed prairie dogs (*Cynomys ludovicianus*). As the public awakens to the need to conserve our oceans, coral reefs and fisheries, large areas of federal waters could also join the System.

Acquisition Through Innovation

The System is a great tool to protect biodiversity and provide wildlife dependent recreation to the public. However, refuges will never solve all of the nation's conservation problems, or provide opportunities for every desired public use. We must look for new ways to create refuges, when and where it makes sense to do so, and to recognize that other tools can be used to achieve overall national conservation goals.

National wildlife refuges (NWRs), acquired in new ways, benefitted endangered species habitats. California, with the establishment of San Diego NWR, became the first state to have a refuge created that complemented the implementation of a regional, multiple-species, Habitat Conservation Plan (HCP), which protects endangered species habitat and still allows for economic development. At Balcones Canyonlands NWR in Texas, the FWS is also

complementing the local Balcones multiple-species HCP by accepting donations of conservation easements from developers of golden-cheeked warbler (*Dendroica chrysoparia*) habitat who mitigate their impacts to the species by purchasing replacement habitat within the refuge's acquisition boundary.

Perhaps the best example of protecting whole landscape functions is the Small Wetlands Program, managed by over 30 FWS wetland management districts in seven primary states in the northern Great Plains. This program began during the 1940s and 1950s, when large-scale wetland drainage threatened the continued existence of the nation's most productive waterfowl nesting habitats. Now, with over 2.5 million acres protected and with a current growth rate of over 100,000 acres per year, a biologically significant proportion of the entire prairie pothole landscape is protected in the System, and those lands yield many recreational, economic and community benefits beyond their wildlife conservation values. Significantly, while all these lands are part of the System, most are not owned in fee by the FWS. Wetland and grassland easements are a large part of this success story.

How successfully the System's mission is achieved will depend greatly on effective work beyond refuge boundaries. Many species that depend on refuges also depend on neighboring lands for part of their life cycle. In-holdings, contiguous habitats and travel corridors should continue to receive high priority for acquisition and protection, whether managed by the FWS, state or other conservation partners.

Opportunities for partnerships beyond refuge boundaries abound through the FWS Partners for Fish and Wildlife Program. Conservation goals will increasingly be achieved through: technical assistance and coordination with the U.S. Department of Agriculture; conservation work on U.S. Department of Defense lands; watershed restoration activities in coordination with the U.S. Army Corps of Engineers and the U.S. Bureau of Reclamation; and cooperative agreements with state agencies, local governments and private parties. We need to recognize these opportunities and capitalize upon them. Most future land protection will be through easements and management agreements. Costs for acquiring a conservation interest in this fashion will likely approximate 35 percent of the fee acquisition value, allowing for a three times faster rate of protection while lowering operational and maintenance costs, resulting in satisfied, private landowners and neighbors.

Challenges

The increasing complexity of refuge management is unlikely to diminish. Herein, we highlight some of the many management challenges: habitat loss, invasive species, water resources, workforce development and planning.

Habitat loss may result from natural and human-induced events or conditions, and it may occur gradually or immediately. Though laws, policies and public awareness have slowed the rate of loss in recent decades, we still lose habitat daily. Refuge managers are challenged not so much to address the large-scale issues. Rather, we are challenged to prevent habitat loss on the refuges we balance ecological functions lost elsewhere and to work with partners to magnify mutual successes. We have considerable experience in habitat management techniques, from applying prescribed fire to creating and managing wetland impoundments to restoring native grasslands. However, we must be open to new ideas and tools, foster new partnerships, and examine our activities for their intended and unintended effects. We must quickly adapt to new technologies as they are developed.

Invasive species will be one of the System's biggest challenges in the next 100 years. More than 675 invasive species already occur in the System with over half of the refuges affected. Maintenance of native biotic communities will become increasingly difficult. In some cases, invasives left unchallenged will overwhelm refuges and prevent achievement of their purposes and goals. In the worst cases, invasive species will become primary causes of some species extinctions. We will need new and better tools to combat this invasion; the current state of integrated pest management will prove inadequate. Focused biological control, more selective chemicals and careful genetic engineering may hold promise for the future battles, but, to win this war, the FWS and its partners must devote new energy and resources to the fight. Anything less will likely fail. In some instances containment of invasives, at least slowing their spread, may be the only realistic goals. In the face of potentially astronomical control costs, or in the absence of effective control methods, difficult choices will be required.

Water quantity and quality necessary to meet individual refuge needs is already a huge issue that will escalate in significance. Complex and controversial negotiations over water resources will dominate the careers of many future managers. The System will need to increase its level of expertise in the biological, social and legal aspects of water management, and it should look to state and local partnerships to address future water issues in a proactive fashion.

Building a workforce for the next century is no less a challenge than our biological ones. We must prepare ourselves for the realities that lie ahead and develop the staff talents that tomorrow will require. To be effective, we will still need the traditional knowledge and skills of wildlife management, biology, general science, planning and accounting. However, for success in the 21st century, managers must be even more attuned to the sociopolitical world and be increasingly effective communicators that are adept at resolving conflicts and negotiating acceptable outcomes. We must recruit people with these abilities, provide training and mentoring to strengthen and refine their skills, and help them find a home in our organization. We need to diversify our workforce to add depth to our decision making and communicate better with a diverse North American public.

Planning has become a crucial part of refuge management, yet we continue to be challenged to use the planning process as effectively as we should. The complexities of today's public land management policies, compounded by increased threats to the land and broad, often conflicting public interests, have resulted in a process that cries out for improved methods for analyzing alternatives and for building consensus.

Public Use and Support

Most refuges enjoy an atmosphere of support in their local communities—until a specific project is stopped due to land status. It may be a proposed new road, power line, youth camp or recreational ski area—all valid projects but all inappropriate for a NWR. The concept of appropriate use and understanding that the System was not established for multiple use is perhaps the biggest educational need facing the System today. People become disillusioned and their support for refuges wains as they see their small, relatively benign project die at the hand of a refuge manager who is required to meet the mandates of the NWRSIA or other conservation laws. The General Accounting Office (1989) reviewed incompatible uses of NWRs and found that secondary uses, harmful to wildlife resources, were widespread on refuges. Such uses were occurring for two primary reasons: (1) lack of FWS jurisdiction over the refuge's land, water or subsurface mineral rights or (2) FWS's inability to resist external pressures in managing secondary uses. Some managers were willing to accept adverse effects as a price of obtaining public good will, and, in about half of the

cases, the price was too high. New refuge policy (U.S. Fish and Wildlife Service 2000) sets a strict standard for compatible uses, stating: “Fragmentation of the National Wildlife Refuge System’s wildlife habitats is a direct threat to the integrity of the National Wildlife Refuge System, both today and in the decades ahead. Uses that we reasonably anticipate to reduce the quality or quantity or fragment habitats on a national wildlife refuge will not be compatible.” The long-term management principle here is that you cannot give up little pieces of functioning wildlife habitat—a little here and there—and ultimately end up with anything useful. Uses that do not support a wildlife conservation mission or the compatible human enjoyment of wildlife should not be permitted.

The System began with a single purpose—to provide inviolate sanctuary to overexploited populations of migratory birds. The rapid and successful growth of the System transpired, in part, because the strict preservation mandate was modified. Tangible benefits of land use designations are critical for societal support. Protecting wildlife is good; protecting wildlife and allowing people to enjoy wildlife is better. This is not multiple use, but some public use is part of the equation.

The NWRSA legislatively established a conservation mission for the System and mandated the maintenance of the biological integrity, diversity and environmental health of the System. The act also defined compatible wildlife-dependent recreation as, “legitimate and appropriate general public use of the System.” It established hunting, fishing, wildlife observation and photography, and environmental education and interpretation as priority public uses to be facilitated when they are found compatible with individual refuge purposes, and the System mission. How well these and other mandates of the NWRSA (e.g., planned growth, effective coordination, maintenance of adequate water supply, monitoring of wildlife population status) are followed, more than anything else, will dictate the future of the System.

The Future

Continued human population growth and urbanization in North America are near certainties. These certainties, along with the continued modification of natural landscapes, challenge the sustainability of North America’s fish, wildlife and plant resources, but it also increases their intrinsic value. While urban expansion and related threats will increase, technological advances will also.

Some of those advances will provide new conservation tools, and others will reduce the impacts of urban expansion, by design. Hawking (2001) reported that the number of scientific articles published each year grew exponentially in the last century (9,000 articles published in 1900, 90,000 in 1950, 900,000 in 2000). If even a small fraction of this scientific work results in new discovery, we are in for big changes indeed!

One hundred years ago, it was doubtful that even a few visionaries would have thought humans would walk on the moon, yet that event is now beyond the living memory of the most recent generation. In recent decades, wildlife managers have benefitted from technological advances in global positioning system technology, radio telemetry, satellite photography, cellular phones, computer microchips, capture drugs, DNA identification and replication, and geographic information system computer mapping. The next century will offer new technologies beyond our wildest imagination.

Most exciting is the promise of discoveries to revolutionize human society that likely awaits us in the near future. Such things as powering automobiles and generating electricity from hydrogen gas derived from ordinary water molecules—the technology for clean, efficient and inexpensive energy—is close at hand. Beyond the many obvious benefits, a diminished need for pipelines and transmission lines would help to reduce habitat degradation and fragmentation.

Predictions

In preparing this paper, the temptation to prophesize about the System of the future and about the related matters that will impact the conservation of both the nation's and the world's wildlife could not be resisted.

We predict that refuges will increasingly become isolated islands surrounded by development, but we also envision increased public support for their protection. We will continue to protect some of the best of the best wildlife habitats, and we will provide invaluable opportunities for the North American public to rediscover their wildlife heritage to escape the burdens of everyday life and to enjoy the peaceful call of nature. Just as communities now fight for their parks and increasingly recognize open space as quality of life urban infrastructure, they will aggressively support refuges as important sanctuaries for wildlife and people.

Can natural processes of the System, the nation and the world be sustained over time? Orr (2002) writes, "The overall challenge of sustainability

is to avoid crossing irreversible thresholds that damage the life systems of Earth while at the same time to create long-term economic, political, and moral arrangements that secure the well-being of present and future generations.” While Orr is speaking to global sustainability, the same basic principles apply to the System. We believe the System can and will be sustained. Sadly, we do not believe that the diversity and abundance of the world’s, or even North America’s fish and wildlife and habitats, will have the same fate. This will make the products of the System and its conservation partners even more valuable in the future.

The System will increasingly be the world leader in preserving and restoring fish and wildlife habitats for the wild creatures that depend on them. These benefits will be expanded through the complimentary work of the states and private property owners on adjacent lands.

This prophecy is not intended to be all gloom and doom for those many creatures that do not live within or near a refuge. On the contrary, we predict that there may be a turning point, globally speaking, for the environment.

Looking ahead 100 years, we see a near complete abandonment of fossil fuels. Democracy and free markets will hopefully be well-established throughout the world. Education levels and standards of living in much of Latin America, Africa and Asia may be equivalent to those in Europe, Japan and the United States. If so, immigration to the United States could slow to a trickle, and, after adding approximately 50 million people, the U.S. population may level. Birth rates may fall worldwide, and there could eventually be a zero population growth across the planet. Cold fusion energy will be fully developed, and there will be inexpensive, virtually unlimited, supplies of potable water for human consumption through desalinization of sea water.

Some climate change will occur, and there will be loss of some species. Global warming, and the resulting melt of polar caps and raising sea levels, will have significant impacts to wildlife. Many coastal refuges may only be viable if significantly diked. More than 2 million ducks, geese and swans nesting on the Yukon Delta NWR may lose much of their nesting habitat, and approximately 40 million seabirds nesting on rocky points and islands of the Alaska Maritime NWR may suffer major impacts in habitat availability and quality. In some areas, inundation of coastal areas may eventually create new salt marshes and important wildlife habitats that did not previously exist.

We expect that there may be drastic changes in wildlife numbers as efforts to protect some species benefit others, or disease takes a high toll in

animals that will be increasingly concentrated. Diseases may significantly alter both human and wildlife population densities in the future as in the past. In some cases people may grow to fear wildlife if outbreaks, like West Nile Virus, bubonic plague or hantavirus, emerge at epidemic levels. Managers may have new tools to aid in disease detection and prevention as well as such things as the ability to clone threatened and endangered species to aid their recovery.

Human populations in the United States will likely be even more concentrated on the coasts and major urban centers while large areas of the West and the upper Midwest will remain less populated. In the West, grazing and mineral extraction will likely be very minor industries, largely replaced by tourism, recreation and high technology jobs. This could lead to the availability, ultimately the addition, of large tracts of lands to the System. North Americans will value greatly their wildlife refuges, and the System will receive more than 100 million visits from the public each year.

We predict that the public will demand, and the FWS will promote, expanded and enhanced interpretation and environmental education programs throughout the System. Refuge interpretation and education staffs will become increasingly professionalized. Many refuges already judge the success of their public programs on the number of school buses that visit each year, and that number will grow substantially. Look for greatly expanded partnerships with local school districts and other organizations. And, more refuges will follow the models of the Sweetwater Marsh, San Francisco Bay and Noxubee NWRs, constructing and operating facilities and delivery of programs through local jurisdictions on refuges. The historic goal of bringing students to refuges for hands-on learning will persist, but the next century will see continued growth in refuge participation in the world of virtual learning. Refuges will be connected to schools via computers and other technologies yet undreamed of. The Internet, and whatever follows it, will become the way that many, if not most, school children connect with refuges.

Hunting and fishing are traditional activities that have connections to the origins of humankind. Today, opportunities for these uses are increasing within the System but not without considerable controversy. The long-term future of hunting and fishing on refuges depends on the interest and acceptance of these uses by society at large. As long as states legally allow these activities, the System will offer them, when compatible, and that they will be high-quality experiences.

There will be increasing demands for public access for both consumptive and nonconsumptive uses of wildlife. Limits will be placed on numbers of people

allowed on refuges, resulting in competition for opportunities in many areas. More refuges will require reservations and will hold lotteries for wildlife viewing opportunities, as has historically been practiced some places to allocate duck hunting blinds. Some auto tour routes will be closed to private vehicles, and cars will be replaced by mass transportation vehicles. Free access will likely disappear in many areas, replaced by user fees to help offset the costs to administer visitor services. Finally, we believe that there will be hundreds of thousands of acres of the System where access will be limited and highly supervised, where participation will be in groups, yet millions of acres of refuge land will remain where visitors can wear out good shoe leather, tramping over miles of field and forest in relative isolation.

Cautions

Following are a few cautionary areas, based on our experience, that, hopefully, will influence managers of the future.

Organizations come and go, and wildlife managers and administrators can easily get caught in reorganization efforts. The FWS got its humble beginnings in 1871, with the creation of the U.S. Commission on Fish and Fisheries, and in 1885, with the establishment of the Office of Economic Ornithology. Since that time, we estimate that it has undergone at least 12 major reorganizations, including changing departments, adding and deleting various fisheries responsibilities, and transferring other responsibilities to other agencies, for example, animal damage control and research functions. It will change again—many times. Although the System has always had a home within the FWS, or one of its precursor agencies, it may not always be so. It is quite possible that the System will be a separate, independent bureau within the next century. The System may be housed within a new, federal Department of Natural Resources, combining several agencies within the current U.S. Departments of the Interior and of Agriculture. Or, the regulatory functions of the FWS may be placed with an agency like the U.S. Environmental Protection Agency while the System is combined with other land management agencies in the U.S. Department of the Interior. We do not worry about such things! And, hopefully, future managers will not worry about such things either. The caution is to spend what precious time is available on those things that can influence most.

Be cautious of shifting baselines. Pauly (1995) speaks to the recently acknowledged problem of accepting a lesser environmental standard because we

didn't really notice the losses along the way. Pauly et al. (1998) state that, "the number of Pacific salmon in the Columbia River today is twice the number of the 1930s." That sounds good, if the 1930s was your baseline, but salmon in the Columbia River in the 1930s were only 10 percent of what they were in the 1800s. The 1930's number reflects a baseline that has already shifted. The same can be said about most things, from air and water quality to species abundance and diversity. We must understand our baselines for managing the System, refuge by refuge, setting reasonable goals and monitoring trends. We must also not be shy about implementing aggressive adaptive management mechanisms to get things back on track; rather, we must accept a slowly shifting baseline. Special attention should be given to the System in managing its over 20 million acres of congressionally designated wilderness in a fashion that prevents degradation of wilderness values.

We must be cautious of scientific arrogance. We must remember that, even with our rapid increase in scientific understanding, we will know a fraction of what there is to know. As children, some of us (in what we felt was a safe and modern world) could go to the local drug store and buy elemental mercury or a bottle of formaldehyde to play with, not knowing their dangers. Now, we must not become comfortable with current levels of knowledge. We cannot avoid making management decisions without all the answers, but we should always be cautious, even when social and political pressures will chastize us for doing so.

We must not forget people. We must not forget the System's mission statement, "for the benefit of present and future generations of Americans." It is easy to get caught in managing a crisis, going all out to do the right thing for wildlife and, regrettably, viewing some of the public as the enemy. They are not. Who do we work for? Do we work for the President? Do we work for wildlife? Do we work for the North American public? Yes, all of the above! We work as part of the executive branch of government, on behalf of North America's wild creatures, and for North Americans. An agency of government is destined to either be sustained with the support of society or become irrelevant and extinct in its absence. We must never forget that.

Conclusion

Refuge management and wildlife conservation are not rocket science. They are much more difficult than that. We can calculate with precision how

much fuel is required to power a rocket of a certain size beyond Earth's gravitational pull, but there is much that we do not know about the nature of nature. Yet, that is to be counted as one of the good things. Uncertainty spawns challenge, challenges bring rewards and rewards refuel the inquisitive mind. So, the cycle continues to provide a sense of discovery and accomplishment to all who visit wild places: school children, scientists, hunters and wildlife watchers. The System provides a link to the past and hope for the future. Visit it; you will be glad that you did.

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Session Two.
***Conservation on Private Lands:
The Buck Stops Where?***

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**Using U.S. Department of Agriculture Farm Bill Programs
to Address Agricultural Viability and Biological Diversity
at Multiple Scales in Connecticut**

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Introduction

Connecticut's natural resource and rural issues are a microcosm of those that the nation faces or will face in the next century. They exemplify the emerging challenge of managing the urban-rural interface. Historic land-use patterns and subsequent sprawl development have created a highly fragmented landscape in which the intertwining of urban, agricultural, rural, residential and wildlife habitat land uses has placed agricultural viability and biological diversity (as well as human health and quality of life) at risk.

Throughout the United States, U.S. Department of Agriculture (USDA) Farm Bill Programs are offered by the Natural Resources Conservation Service (NRCS) to private landowners to implement conservation practices that protect

natural resources. In Connecticut, NRCS uses programs as tools to accomplish two important missions:

- facilitate and mediate civic work: “Government is really the facilitator and mediator of civic work. I think the person who can engender the spirit of cooperation is the one who is going to be the most successful”
- restore, protect and enhance ecosystem functions: “Human societies depend upon functioning ecosystem services that, it is estimated, are worth at least \$33 trillion annually, several times the global gross domestic product . . . It can be convincingly argued that human health and welfare are enhanced through restoration of damaged ecosystems, and that it is thus in our best interests to do so.”

Our work with communities and individuals is done at a variety of spatial scales, ranging from field borders under the auspices of a single landowner to watersheds involving multiple partial jurisdictions. NRCS in Connecticut utilizes a systems-approach that facilitates a collaborative, locally led, decision making and resource assessment process that is melded with interdisciplinary technical assistance provided by teams. The results are on-the-ground applications with cumulative impacts that effectively meet agency, community, landowner and ecosystem needs. These processes and examples, which I will review today, can be replicated nationwide.

Resource Assessments at Different Scales

Utilizing hierarchical planning concepts to perform resource assessments at different scales helps to understand the relationships between local, natural resource concerns and major, ecosystem stressors.

Strategic Level Examples

- ecological units of the eastern United States (U.S. Forest Service)
- national resource inventory (NRI) and analysis (NRCS)
- migratory bird flyway maps
- major land resource areas (NRCS).

Tactical Level Examples

- unified watershed assessment of Connecticut watersheds
- The Nature Conservancy’s priority focus areas

- geographic information systems (GIS) map displaying agricultural areas in relation to public drinking water supply watersheds (statewide)
- GIS analysis maps displaying priority habitats (statewide).

Operational Level Examples

- stream and riparian health inventories for small watersheds (Connecticut Streamwalks)
- whole farm assessments for the Environmental Quality Incentives Program (EQIP) participants
- areas of local concern identified by locally led groups
- analysis of patch-type dynamics in the Norwalk River Watershed.

Collaboration as a Tool for Local Involvement

Connecticut NRCS has committed to working with communities in the state. Collaboration in Connecticut is the deliberate attempt to work in partnership with communities, recognizing their strengths and providing assistance where gaps are found, to ultimately increase community capacity for conservation decision making. Collaboration takes into account social and environmental sciences and, especially, seeks to understand the environmental values that provide motivation for communities and individuals for conservation. Collaboration is the ethical response of government to meet the conservation needs of communities.

It is our experience that communities that have been through this process are the most successful. It results in a better understanding of their resource setting and the impacts of their decisions, what actions to take and why, and what kinds of financial and technical assistance to request from NRCS and other partners.

Locally led conservation is a concept that originated with the 1996 Farm Bill and continues with the 2002 Farm Bill. It is the unique opportunity and mechanism for the direct involvement of citizens in the design and implementation of government programs. This process of collaborative, stakeholder meetings brings decision making to the local level, instead of the usual top down approach. Benefits include:

- identification of local resource concerns
- community understanding of landscape setting and ecosystem impacts

- a platform for communication between government and citizens
- development of action plans for grassroots organizations
- development of new partnerships
- leveraging of resources
- development of program criteria that meets state and local needs
- prioritization of issues
- input for state technical committee decisions
- identification of measurements of success.

Development and Use of Programs as Tools

Many of the policies and guidance for the use of conservation programs is defined by lawmakers, the rules process and the agency. The challenge is to design and implement programs that address national priorities yet are flexible enough to meet diverse state and local needs. Resource inventories and assessments, as well as information from collaborative, locally led meetings, can develop criteria and ranking systems that will effectively address regional and local resource concerns and ecosystem stressors, and they will optimize environmental benefits. Then, you have the right tools for the job at hand. Examples include:

Environmental Quality Incentives Program

- starts with a whole farm assessment
- provides points for addressing Connecticut's top five resource concerns, identified by locally led processes
- provides points for benefits to threatened and endangered species, protected farmland and public water supply areas
- leverages other resources.

Wildlife Habitat Incentives Program

- starts with site assessment at a variety of scales
- focuses on protection, restoration and enhancement of ecosystem structure and function
- provides points for benefits to important, broad habitat types
- provides points and priorities to projects that protect, enhance and restore Connecticut's 13 most imperiled ecosystems and associated species.

Conservation Technical Assistance

This program provides facilitation and mediation of civic work through a variety of mechanisms. Examples include:

- GIS, soils and landscape analysis for community planning
- farmer research groups
- assistance to watershed groups and land trusts on development of action plans.

Development of an Organizational Structure for Effective Implementation

Natural resource issues in Connecticut are complex, expensive and exist in a highly regulated environment with many stakeholders. Striving to become both effective and efficient, we adopted the following strategy:

- use of an interdisciplinary approach for planning and implementation
- a group of specialists to assess and rank applicants
- use of collaboration within work groups
- development of individual specialties
- use of an interdisciplinary management group to direct the work.

Effectiveness and Accountability

The Government Performance Results Act, Administration initiatives, and agency accountability systems require a certain level of documentation of accomplishments emphasizing the government and the taxpayers getting the *biggest bang for the buck*. This emphasizes efficiency, achievement of program expectations and greater accountability on how government resources are used. Our challenge is to make sure the accomplishments we are counting and sorting are tied to the resource setting and restoration or the protection of ecosystem health. We struggle to answer questions. Are we doing the right things right? What are the right things? How will we get them done? What is the most efficient way of doing the right thing? Resource assessments and analysis help to define the context of the right thing. In combination with locally led input, we are able to balance national priorities with state and local needs, to use programs as tools to get the right work done, and to deploy them appropriately. This provides accountability through our cumulative accomplishments and assures both efficiency and effectiveness. Examples of accountability include:

- maps that display the location of our work in relation to natural resource issues and features
- monitored practices to evaluate effectiveness
- display and analysis of NRCS Performance Results Measurement System results
- development of success stories.

Summary

As a society, we may not have been making the best choices for the long-term. In Connecticut, the complexity and urgency of our natural resource issues forced us to work differently. We continue to learn and make midcourse corrections to these processes and perspectives. And, there have been many successes that show we are moving in the right direction. To successfully use government programs as tools to address ecosystem stressors as well as individual and societal needs will require:

- a better understanding of the state of the land and what it needs from us
- collaboration for interaction and developing locally led conservation
- development of true partnerships
- reengineering to gain efficiency and effectiveness.

Assuring Accountability at Multiple Scales

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“Today’s problems cannot be solved with yesterday’s knowledge. If this were so, the problem would not have arisen in the first instance.”

—Albert Einstein

Success, not just beauty, is in the eye of the beholder. Our perception of the success of government conservation programs depends upon the trust that government managers execute these programs in the public interest. But, trust alone has its limits. We also want proof that the programs actually address the problems for which they were conceived. To this end, we demand accountability. Accountability, in turn, requires data.

Much has been made, in light of the Enron and WorldCom scandals, of corporate accountability to the stakeholder, i.e., the owner of the shares in the public corporation; government accountability follows the same concepts. The system works when, as Plato intimated in *The Republic*, everyone knows his or her role within the larger system, and each provides proof that he or she indeed performs as expected. For the corporate sector, verification of performance occurs, at least in theory, through monitoring by disinterested observers or accounting firms. For government programs, it is government entities, such as the General Accounting Office (GAO) and the Office of Management and Budget (OMB), that are separate from those that deliver services. With the increasing trend towards the privatization in the delivery of programs and the growth of dollars supporting them, the need for accountability at all levels becomes more urgent.

The enactment of the Government Performance and Review Act (GPRA) gave increased impetus to improving the accountability of government programs in recent years. The National Academy of Public Administration and public administration scholars call it, “managing for results.” For programs designed to improve or protect environmental conditions, it means setting environmental goals and objectives in quantifiable or measurable terms, linking strategies and activities

to meet them, and measuring the results. All federal agencies providing services have been tasked to identify program goals, establish measurable performance objectives (or indicators), and show how their programs meet those objectives. The results of these exercises can be gleaned from their Websites and regular reports to Congress.

Performance measures for government agencies that deal with natural resources can range from indicators of how efficiently an agency is spending money to those that measure the changes in the state of the resource or environment. A cooperative project by U.S. Environmental Protection Agency and Florida State University describes the hierarchy of indicators used to provide information on the effectiveness of a program. At the highest rung are changes in health, ecology or other effects that directly measure the health of humans, wildlife or a resource. The report acknowledges that there are, unfortunately, few areas where one can base performance on such definitive, end-result measures. In lieu of such quality indicators, other, less direct measures are used. Indicators lower on the hierarchical scale show changes in the amount of pollution or discharges to resources of concern. The weakest indicators that are furthest from actual ecological results are actions of agencies or responses by the affected community. Examples would include acres of land treated, dollars spent on conservation programs and the number of clients served. Congress expects that the money and government institutions established to execute programs and dispense money solve the environmental problems, e.g., rebuild threatened bird populations or improve water quality. Knowing how the money was spent is clearly a critical first step and a building block of good government, but it does not go far enough to answer the ultimate societal question and give the citizen what he or she wants.

In complying with its GPRA requirements, the U.S. Department of Agriculture (USDA)—in particular the Natural Resources Conservation Service (NRCS), the primary federal agency delivering conservation services to private landowners—established performance measures that fall into the two lower rung categories serving to inform Congress how its money was spent. Its emphasis on improving accountability has been on tracking where money has gone and what it has bought. Programmatic performance is measured in terms of dollars spent on so many practices on so many acres of land. In this regard, the agency shows considerable progress.

Improving fiscal or administrative accountability is clearly necessary. Achieving this milestone, though laudable, is certainly not the end of the effort

however. The larger societal questions—those that rate high on the hierarchy of indicators—remain. Do the programs work? Do they succeed in mitigating the negative impacts of agriculture on the environment? Do they protect resources at the scale at which society cares, at the geographic scale at which the longer-term sustainability of the system depends—the landscape or watershed? The measurement results—miles of fences or acres of riparian buffers—do not communicate what public opinion surveys indicate producers and the general public want: increased bobwhite quail populations, for example, or clean water. USDA needs to communicate its successes in a more useful form to taxpayers and their government representatives.

Producers want to know if a conservation practice will, for instance, bring back the greater prairie chicken to land or if it will decrease nutrient loss to streams and rivers bringing the agricultural operation in compliance with water quality standards. The public beyond the farm wants to know if the aggregate effect of these practices on all the farms increases biological diversity, saves species at risk and protects water quality. In other words, conservation programs must not only achieve a given level of positive environmental result at the level of the individual project or farm, but they must also be of sufficient intensity to offset the collective impact of the land management across the landscape or watershed.

Data on miles of fences or acres of riparian buffers do not answer this latter question, let alone the former. The overall effectiveness of conservation programs at both the level of the farm and the resource or watershed—the level that elicits public concern—depends upon a number of factors with the acknowledgment that only some of these factors are under the control of the individual landowner or the government agency that manages the program.

Conservation initiatives funded through USDA programs may simply not work as designed or intended for a variety of reasons, some related to intrinsic properties of the farm and others that go beyond the farm. Conservation programs must compete for the attention of landowners with market prices and even other government programs, such as commodity price support or risk management programs. A green payment program, for example, that pays a farmer to retire a strip of land along a river or stream may elicit too few participants if commodity prices or government support payments are so high that it becomes the interest of the farmers to continue to crop the land, given the relative financial return. Or, a farmer in a watershed may enroll highly-erodible

land in a land retirement program, such as the Conservation Reserve Program (CRP). Or, bottomland may be enrolled in the Wetland Reserve Program (WRP). But, the farmer then may decide to crop the same number of acres by converting neighboring upland marginal land for crop production. The net environmental gain within the watershed may be minimal at best, if at all.

The intervention, should it have scant measurable impact at the larger resource level, may be justified for the benefits it provides to the individual farm. But, we need to know this, and principles of good government demand that we know this. The measures of success that USDA uses to communicate to the private landowner, the larger community and Congress that the programs work must be in terms that are useful to the landowner and the public. It must be tied to results that are valued by the interested parties: cleaner water, wildlife species' return, healthier soil.

The following example, reported by Iowa State University's (ISU's) Leopold Center, illustrates the need to go beyond administrative indicators of performance for conservation programs.

In Iowa's Great Lakes region, more than 300 wetlands have been restored and large amounts of agricultural land have been retired. But, have the environmental problems, which are represented by higher-level performance indicators, actually been solved? ISU undertook a study of water quality in the region and found that the flow of nitrates, phosphorus and other nutrients into the lakes continue. "We found that the overall water quality has not changed in 30 years and in some cases, it has gotten worse, despite a lot of water quality improvement projects in the watershed....Phosphorus levels remain about the same and if anything, nitrate levels seem to be considerably higher" (Miller 2001) Against existing NRCS performance measures, agricultural conservation programs in this region should be deemed a success. Nevertheless, against the most important measure—the problem for which the practices were implemented to solve—the grade is clearly unsatisfactory. Drainage tiles, which needed to be broken in order to interrupt water flow, remained intact. Wetlands that were restored were not located at critical points in the watershed or were not large enough to handle nutrient loads. The result is a lot of money and time spent with little water quality to show.

A June 2001 workshop on the Farm Bill and the environment, sponsored by the Wallace Center of Winrock International (Wallace Center), University of California's Berkeley Center for Sustainable Development, ISU's Center for

Agricultural and Rural Development, the National Association of Conservation Districts, and Kansas State University's Department of Agronomy, posed seemingly simple questions related to performance to a variety of experts drawn from industry, academia, nongovernmental organizations (NGOs), and government. The workshop asked how successful are we in protecting our natural and agricultural resources from the adverse effects of agricultural activities? The answers we received follow.

- Though there are many environmental databases relating to agriculture, most are unreliable for the policy questions posed. Moreover, the means or tools to interpret data need to be made available (where they exist) or developed (where they are needed).
- Where we do have data, we know that degradation of air, water and wildlife resources continues. More than one thousand species have been endangered, threatened extirpated over the last 30 years and this number may increase five-fold over the next 30 years. Agriculture is sometimes directly responsible. In other cases, actions could be taken by agriculture to alleviate these losses.
- The degrading agricultural lands have been observed across the United States. In many areas, there remain severe soil erosion problems. Farmers rely too heavily on chemicals—either prophylactically or in reaction to soil degradation—leading to declines in soil and water sources. Agricultural intensification and conversion of marginal lands, without mitigation measures, aggravate these problems.
- Though the rate of wetland loss in the United States has declined in recent years, the loss of functional equivalence continues. The challenge remains to improve our ability to restore and protect the functions and values of wetlands.

Key conclusions pertaining to performance and accountability of USDA's conservation programs were made. For example, a crucial element for an effective environmental conservation program is the establishment of quantifiable objectives and measures of performance. Use of spatial data (data relating to where one is in the watershed or landscape) to assess agricultural productivity and to develop environmental indicators is an essential element in the design of effective technical delivery programs. Existing, working land programs have paid farmers for activities rather than for performance. Payments should

be based upon results with a clear link between agronomic practice and environmental outcomes. Outcomes need to be defined in a way consistent with the time period of performance since many resource improvements may take many years, if not decades, to effect.

Also, greater flexibility at the local level in the design and delivery of conservation programs, which was acknowledged as important for addressing the heterogeneity of agricultural practices, environmental conditions, and objectives in different regions, must come with greater accountability for how funds are spent. Effective policies require an effective system of monitoring and evaluation that should be implemented through an independent third party system.

Finally, rules on government accountability provide the impetus for more effectively communicating the results of conservation programs to all involved. Results should be expressed in terms of the values defined by Congress—soil, water, air and wildlife enhancements.

One of the outgrowths of the workshop was the creation of an ongoing workgroup, the Conservation Working Group, whose core members include the Wallace Center, the Wildlife Management Institute, The Wildlife Society and the National Association of Conservation Districts. The participants commit to improving the accountability of agricultural conservation programs. Accountability requires data; the quality of the data depends upon clear articulation of expectations. In the case of conservation or environmental programs, it also depends upon sound understanding of the science. The working group provides an avenue for scientific and policy exchange among various levels of government, the private sector, NGOs and academia.

As noted by the Farm Bill and the environment workshop, establishing this level of accountability for solving the ecological problems of watersheds and landscapes is beyond what we can expect of a federal agency. Just as we assure corporate accountability with third party agents to monitor and evaluate performance, we need to subject government programs to third-party review. The responsibility of the government programs is to generate and provide the programmatic data (low and midlevel indicator data) that support this review. Results-based information (or performance indicators), which generally must be generated at the landscape or watershed scale necessary to complete the evaluation can be supplied by third parties, such as universities, NGOs and other government agencies. Collecting information and assessing results should be part of basic program design.

Monitoring and evaluation of higher level indicators and third-party review to ensure accountability for results should not be interpreted as criticism of government managers. The public and stakeholders must understand that result-based performance depends not just on the design and delivery of programs, but a myriad of other factors uncontrollable by the agency. Key among these are the adequacy of funding levels (hence the intensity of intervention), political buy-in from key actors (such as interest groups) and program scope. All of these are determined by Congress, not the specific agency.

Principles of adaptive management—analogue to taking two steps forward in a snow storm and then stopping and looking around to make sure that one is moving in the right direction—state that the effectiveness of the program can only be as good as the physical and social science. Because the science is imperfect and incomplete, so is our ability to construct programs *a priori*. Higher-level evaluation can reveal not only whether or not programmatic intervention worked, but also what changes need to be made to improve performance. Or, it can tell us what our reasonable expectations for performance should be. It is a policy decision beyond the USDA as to whether or not this is enough. With this information, it becomes the responsibility of the public to hold all levels of government, legislative and executive branches, accountable for results.

Let us heed Albert Einstein's admonition and collect the information necessary to assure accountability at various political, administrative and programmatic scales. We owe it to future generations.

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Exploring Opportunities to Apply Conservation Provisions in Iowa

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Iowa's Successful Venture into Private Lands Programs

I have had the unique opportunity to view several Farm Bills through the eyes of a state conservationist for U.S. Natural Resources and Conservation Service (NRCS) and, currently, as the Director of the Iowa Department of Natural Resources (IDNR). Leading each of these agencies through Farm Bills, I can assure you that both agencies will look at the 2002 Farm Bill from their own perspectives. Each agency will have a vision for opportunities and expectations for what may be accomplished if full funding of all measures of the 2002 Farm Bill are realized. In addition, each agency will view their responsibilities for ensuring that their states will capture the opportunities that are possible from the 2002 Farm Bill.

It is important to appreciate fully and to understand some basic differences between the NRCS and state conservation departments. Federal agencies are first required to be more process driven. After all, the federal agencies will ultimately be responsible for program success and failure. State conservationists will be held accountable for how these programs will ultimately be judged. NRCS administrators must be concerned with basic, bureaucratic rule writing, rule interpretation, staff training, appeal processes, consistency and a host of other considerations. State agencies can relate to these bureaucratic processes by thinking about the processes related to setting fish and wildlife seasons, methods of take, and related rules which involve publishing notice of intended actions, monitoring legislation, arranging public meetings and enforcing written rules.

State agencies tend to overlook the federal agency's responsibilities, wanting to jump to the end of the programs. They want to gain—rightfully so—as many acres of habitat as possible. State agencies often are not fully aware of national program implications or program requirements and often increase the complexity of habitat quality needs. As resource professionals, having the

primary expertise in managing fish, forest and wildlife, state agencies also need to understand that they send mixed messages to U.S. Department of Agriculture (USDA) rule and policy makers. These different interpretations need to be viewed with some understanding, thought and respect by each agency's staff when addressing cooperative efforts.

Iowa, like many states, has had excellent success partnering with other agencies and conservation organizations to make some ecological and economic gains through federal farm programs. We are anxiously awaiting the rules for the new programs, like the Conservation Security Program (CSP) and the Grassland Reserve Program (GSP). Legal statutes for responsibilities involving the protection of fish, wildlife and other natural resources charge state conservation agencies with these purposes. Just as importantly, most state conservation departments are also responsible for many environmental resources, such as water and air quality and energy conservation. Obviously, state conservation organizations have a vested interest in conservation provisions and implementation of the 2002 Farm Bill. The IDNR has invested staff and money resources to become a more active stakeholder in the opportunities that are on the horizon of the current farm bill.

Review of Iowa's Past Environmental Challenges

Iowa is one of the most altered states in the nation in terms of ecological communities. In kinder words, Iowa may be described as worked land, producing food and fiber from the best soils in the world. Such agricultural productivity, however, is not possible without environmental cost. Iowa has lost 99 percent of its prairies. Likewise, 95 percent of Iowa's wetlands have been drained.

By 1974, 78 percent of Iowa's original forestland had been cleared. In 1982, it was losing an average of 10.2 tons of soil per acre, annually.

Iowa ranks nearly last in publicly-owned lands, and our farm economy lacks diversity, being increasingly dependant upon major agricultural crops, such as corn and soybeans.

Review of Iowa's Current Private Land Successes

Currently, Iowa leads the nation in the enrollment of conservation buffers, both in acres and contracts. Iowa's current total is more than 350,000 acres.

Iowa also leads the nation in acreage enrolled in the Farmable Wetland Program (FWP) with 52 percent of the nation's total. The FWP acres total over 37,000. This is impressive in light of the intensity of Iowa's farming heritage.

Iowa is sixth in the nation in terms of wetland acres enrolled into the Wetland Reserve Program (WRP), having more than 107,000 acres in the program, and it enjoys a backlog of contributing landowners, donating over 100 million dollars.

Iowa landowners have embraced changes in general Conservation Reserve Program (CRP) ranking systems that have been changed to optimize environmental benefits. Landowners are planting better wildlife habitat mixes and enrolling their most environmentally-sensitive lands. Currently, Iowa has more than 1.5 million acres of CRP lands enrolled.

Since 2000, a private lands program within the IDNR and its partners have provided fish, forest and wildlife habitat improvements on more than 250,000 acres. More than 10,000 landowners have been provided with onsite field visits and plans to link them with federal programs and to provide them the best habitat technical assistance. More than 11,000 targeted landowners have been contacted with specific information about the USDA programs that would work on their farm. Published articles from our team approach to marketing, outreach and program delivery assisted in enrollment of an additional 40,000 acres into USDA programs.

As a result of just the additional enrollment into USDA programs, the landowners have received over 12 million dollars benefiting Iowa's economy from direct conservation payments. In addition, the benefit of these 40,000 acres that will be on our landscape for 10 to 15 years—or in the case of WRP, permanently—is an enormous contribution to wildlife related recreation.

How Iowa Achieved These Accomplishments

I believe the recipe for Iowa's success is fairly simple and can be borrowed by any state. I know that many states already are practicing many of these principals.

Our department has a long tradition of working actively on the State Technical Meeting (STC). In fact, I would say that much of Iowa's success begins with an excellent working group, made of people from very diverse agronomic, conservationists and social interests. Members of the STC regularly

attend and volunteer to work on issues introduced in the subcommittees, such as ranking factors, funding allocations and conservation issues. They are committed to collaboration on any issues presented by a state conservationist. Most of the detailed work passed along by national rules will be considered by a STC subcommittee. Leroy Brown, Iowa's NRCS State Conservationist, will routinely ask for anyone with an interest on any particular program to become a member of the subcommittee. In so doing, a good understanding of the program requirements and conservation issues may be discussed and strategized. In almost every case, the subcommittee reports their recommendations to the STC with confidence all issues have been addressed to the best of the group's abilities. The department currently has four representatives that sit on the STC to represent our diverse perspectives on wildlife, forestry, agribusiness and water quality. Routinely, several other IDNR central office staff attend the meeting and volunteer on subcommittees.

Also, Iowa, like many states, has been blessed with a long history of direct cooperation with the local USDA field offices. In 1974 a reorganization of our wildlife staff relocated almost all wildlife biologists in local USDA service centers. Over the years, these local, resource professionals have developed strong, collaborative ties as well as mutual respect. The same can be said for all our forestry staff and in northeastern Iowa, where the trout streams are found. The fishery has the same local respect. However, in 2000, our wildlife chief, redirected staff and funding resources to begin a formal, private lands, program within the Conservation and Recreation Division. Our important step was to hire staff dedicated to private lands work. First, two, then three wildlife biologists were hired to work in the same geographic area as the NRCS's five administrative-supervisory areas. The concept was to provide fish, forest and wildlife assistance and training to each of the 19–21 local NRCS and FSA field offices. To date, three of these biologists are actually located in the NRCS area office and are supervised by the NRCS Assistant State Conservationist in that office. The remaining two are not located in NRCS area offices but operate essentially the same way, providing support to the local offices in their area upon request.

Iowa's next opportunity was to receive an AmeriCorps Grant and funding for 11 positions to work on Private Lands. An agreement was entered between NRCS, IDNR and the Iowa Agriculture Department to utilize these employees. The IDNR provides administrative oversight, fish and wildlife management training, and funding for these positions. NRCS provides office

space, day to day supervision, training, telephone service, and vehicles for these staff. Our cooperative agreement sets priorities for these staff to reflect a broad range of water quality and habitat work.

Entering into an agreement with Pheasants Forever, Inc.(PF), we were able to hire an additional ten people. These people are called wildlife specialists and are independently located in strategically-placed NRCS field offices where we felt the highest potential for FWP and WRP sign-ups would be possible. Seven positions in the Wildlife Bureau were redirected to work strictly on private lands. One additional wildlife specialist was hired as a private lands geographic information specialist (GIS) posted in the central office. This position provides technical support and training that is vital to our efforts as well as to the efforts of private land partners by mapping, targeting and tracking our actions.

In total, IDNR has 26 full time positions; although, most of the positions are not held by permanent state employees. The combination of AmeriCorps, PF, and a private employee contractor have provided an avenue to direct staff and provide the critical mass to the Private Lands Program.

Meeting Today's Challenges for a Brighter Tomorrow

State conservation agencies must find and implement new and better ways to collaborate with USDA and other conservation partners, both private and government. This collaboration must be carried out at all levels of government (national, state and local) if the opportunities possible in the 2002 Farm Bill are to be fully realized.

A more businesslike approach to realizing the many opportunities is needed for success. Strategic planning by agency leaders is important to identify all aspects of each program, including program administration, targeting, ranking systems, providing technical assistance, marketing, outreach, and program evaluation and tracking.

New opportunities in technology need appropriate investment in dollars and staffing. In Iowa, data layers of most of our extensive drainage district tile systems, coupled with soil- and land-use cover maps allow for instant mapping of all potential FWP projects in the county. Field visits with landowners can be targeted with precision. Examples of how the program would benefit the landowner financially are part of the initial or follow-up field contact. Lastly, geographic position systems are enabled to map the exact outlines of the project details and are later available for tracking.

Better tracking of program accomplishments is needed. Measurable performance standards, particularly in terms of watershed improvements, are needed. Counting acres or dollars spent is not nearly as meaningful as counting hours of recreation, economic returns, increases in wildlife populations or the tons of soil or phosphorus delivered into the stream or lake. Wildlife researchers can help in this effort.

Closing Remarks

Do the programs of the 2002 Farm Bill have enough to solve your state's environmental problems, specifically water quality, fish and wildlife habitat, and wetland and forest losses? To answer this question it is good to review that funding for conservation provisions, when compared to commodity programs, is currently 23 percent versus 76 percent. Recognizing that no farm bill will perfectly match your state's exact needs and realizing that you may have to change your conservation strategies by adding or redirecting staff or reaching out to form new partnerships will likely be necessary. In Iowa, our fish, wildlife and law enforcement bureaus had operated essentially unchanged for more than 25 years. Some change was in order to invest in the privately owned lands which dominate Iowa. In economic terms alone, our department has invested 2.2 million in over three years of our program. We are just beginning to evaluate the additional recreational hours and benefits to our wildlife populations. We do know, however that we have been able to use an additional 12.2 million dollars in federal money to put conservation on the ground.

You the, leaders in the conservation of fish, forest and wildlife resources, are participants in a paradigm of agricultural and conservation program change taking place across this nation. Many of your conservation careers can track significant change in agricultural policy and politics, as wildlife conservation has become an equal with soil conservation in the Farm Bill. Water quality and energy conservation are emerging as new and greater priorities that have the potential to impact future farm programs. For certain, the current Farm Bill is loaded with conservation programs targeted towards improving natural resources on a landscape scale, something, no state conservation budget can even come remotely close to duplicating. Without question, state fish and wildlife departments can benefit greatly if they have the courage and vision to make the changes necessary to entrench their conservation partners in new partnerships that seek mutual goals by collaboration of their respective strengths.

It will take an unbelievable amount of teamwork, vision, persistence, technology and willingness for agencies and their staff to realize the full potential of the 2002 Farm Bill. The programs are in place and the stakes are high for agencies, hunters, fishers and all conservationists.

Session Three.
***Natural Resources Policy:
Science under the Microscope***

Chair

Doug Crandall

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**Wildfire Policy in Transition:
Where There's Smoke, There's . . . Mirrors**

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Policy making is a reflection of the public's perceived need for change. For much of the 20th century, wildfire policy in the United States meant: all fires out by 10:00 a.m. This policy was instituted in 1935, but evolved out of The Big Blowup, a firestorm that swept the northern Rocky Mountains in the summer of 1910. During this catastrophic event, 5 million acres burned (3 million in Montana and Idaho alone), and 78 firefighters were killed. "As Elers Koch [an early Forest Service official] blandly understated 'The 1910 forest fires in the Northern Rocky Mountains Region is an episode which has had much to do with the shaping of fire policy not only in that region but the whole United States'" (Pyne 1982).

By the late 1950s, the concepts that managed fire can be an effective tool and that fire is essential to the growth and regeneration of healthy forests began to take root. But, these concepts were not adopted by government agencies until the early 1970s when the let-burn policy was instituted for national parks and wilderness areas. The policy was also known as prescribed natural fire.

In 1988, the Yellowstone National Park (Yellowstone) fires brought much attention to ecosystems that were out of balance with what was considered

natural, or presettlement, conditions. This particular event underlined the fact that fire-adapted ecosystems regularly require fire. The 1988 Yellowstone fires emphasized the need for more scientific analysis of ecosystem dynamics.

The public's perceived that Yellowstone was being destroyed, and there was animosity toward the let-burn policy of the U.S. National Park Service. However, three congressional hearings were held and the secretaries of the U.S. Departments of the Interior and of Agriculture appointed a committee to evaluate fire management policies for national parks and wilderness areas. (Franke 2000) Their report, issued in May 1989, upheld the need for fire in maintaining a wildland ecosystem.

For a little over a decade, wildfire policy has been in transition. The most significant policy changes were made after the 1994 fire season, during which 34 firefighters died, including 14 in the South Canyon Fire. The tragedies raised the concern that the potential for catastrophic wildfires was increasing beyond the nation's response capability. (National Academy of Public Administration 2001)

In 1995 the secretaries of the U.S. Departments of the Interior and of Agriculture, for the first time, issued a joint fire management policy to ensure that federal land management agencies would have compatible, coordinated programs. The 1995 Federal Fire Policy acknowledged the role of fire in healthy forests and in reducing the risk of large-scale wildfire: "Wildland fire will be used to protect, maintain, and enhance resources and, as nearly as possible, be allowed to function in its natural ecological role" (Franke 2000).

In effect, the new policy established a second mission for wildland fire managers—to improve ecosystem health and reduce fire hazards. This mission is very different from the traditional firefighting mission. (National Academy of Public Administration 2001)

The Montana fires of 2000 brought attention to the wildfire threat to life and property. The fire situation of the 2000 season was one of six since 1988 that burned more than 5 million acres. At \$1.6 billion, fire suppression costs were at the highest ever. Yet, the 2000 fire season may be the most significant because it became the focal point for discussions of the role of fire on public landscapes, and prompted the rethinking of forest and rangeland management policies. (Freemuth et al. 2001)

The 2000 fire season was pivotal in the development of the National Fire Plan, a long-term, multifaceted strategy, designed to manage the impacts of wildland fire on communities and ecosystems and to reduce wildfire risk. The plan

encompasses the U.S. Departments of Agriculture (Forest Service) and the U.S. Department of the Interior (National Park Service, Fish and Wildlife Service, the Bureau of Land Management, the Bureau of Indian Affairs). The strategy focuses on five areas: (1) improving fire preparedness, (2) restoring and rehabilitating burned areas, (3) reducing hazardous fuels (with an emphasis on multi-jurisdictional efforts to give better landscape-scale protection), (4) assisting communities and (5) researching. Accountability and collaboration on a local level are stressed.

Also in 2000, the U.S. General Accounting Office released a report that found fuel build-up to be a major problem in the West and recommended that the U.S. Department of Agriculture, Forest Service develop a cohesive strategy to reduce fuel build-up. The strategy establishes a framework to restore and maintain ecosystem health in fire-adapted ecosystems in the West. It also focuses on short-interval, fire-adapted ecosystems where lower intensity ground fires frequently occurred, which were a powerful force in shaping the structure of vegetative communities. Three condition classes were defined for the risk condition of short-interval fire adapted areas:

- Condition Class 1—lowest risk of destructive wildfires, closest to natural conditions, where fire intensities are low and generally ecologically beneficial
- Condition Class 2—denser vegetation because several cycles of fire have been missed and natural thinning effects of fire have been lost, where there is a higher risk of destructive wildfires due to increased fuel load
- Condition Class 3—many missed fire cycles, where there is much dead and downed material and many small trees; these areas are at the highest risk for intense and catastrophic wildfires.

The strategy identified high priority areas for treatment: the wildland-urban interface, municipal watersheds, threatened and endangered species habitat and maintenance-treated areas.

In August of 2001, a 10-year comprehensive strategy was developed to guide management of wildfire, hazardous fuels and ecosystem restoration. This was done in collaboration with governors and in consultation with a broad range of stakeholders. The scope includes federal, state, tribal and private lands. The core principles of the strategy are collaboration, priority setting and accountability.

In 2002, western drought, combined with forest conditions, produced further evidence of extreme fire behavior. West-wide, more than 6.4 million acres were burned, thousands of structures were lost and suppression costs exceeded \$1.4 billion. Nearly 40,000 firefighters were mobilized to battle blazes all summer.

The drought ushered in an unusually early fire season for the West. The fires began in New Mexico on March 23, 2002, when a two-day drive of wind contributed to the destruction of many homes in southern New Mexico, near Ruidoso. The Rocky Mountain Area experienced fire activity, including high-elevation fires, four to five weeks earlier than normal, due to persistent drought conditions and a spring snow pack that was only 20 to 40 percent of normal. The nation went to preparedness level 5 (the highest level) on June 21, 2002, and it remained there through mid-August. The nation set a new record for the number of days at preparedness level 5—62 days. (National Interagency Coordination Center 2003)

The evacuation of more than 81,000 Coloradans from their homes and communities highlighted the increasing exposure of wildland-urban interface areas to loss of life and property from wildfire. This exposure prompted the Federal Emergency Management Agency to issue emergency declarations on 17 Colorado fires.

In 2002 a presidential proposal, called the Healthy Forest Initiative, was released. This initiative was designed to facilitate projects that reduce wildfire hazard and risk by making decisions in a more timely and efficient manner. Emphasizing collaborative processes to identify projects and priorities, the administrative proposal seeks to increase the use of categorical exclusions for fuel reduction projects, looks for ways to streamline the appeals process within the existing appeals framework and seeks to streamline the environmental assessment documentation process. Where does fire policy in the United States rest now?

In the early 1900s, the public perception evolved—all fire is bad—so policy was created to suppress all fires. This policy led to a nation of forests and ecosystems that were out of balance with their biological imperative; forests were overly dense, unhealthy, vulnerable to insects and epidemics, and they were excessively fire-prone.

Gradually, it became apparent through scientific study that our ecosystems were out of balance and that, in order to restore ecosystem health,

fire must be reintroduced. It took many years for public perception to change—some fire is good—and for policy that reflects this attitude to be adopted.

Today, the public is asking why we are experiencing such extreme fire behavior on such a large scale that threatens life and property. They believe that something should be done, and, increasingly, that means managing the forest. Beyond the smoke recognition, comes the mirrors. What to do, where to do it and how to implement management continues to create debate and controversy.

Do we treat only around homes or to subdivision boundaries or into the forest? Do we take only the small material or restore presettlement conditions with openings and fewer trees? Do we leave some fire regimes as they are and let nature take its course? Should natural resource managers expedite action or take a more deliberative approach? What should be done about land-use requirements and personal responsibility?

Two U.S. presidents, their cabinet secretaries that were responsible for natural resources, the western governors and Congress have made this issue a priority. Wildfire has never received so much attention in North America. Leadership has set the stage. Action is expected and the public is aware that our western forests are in trouble. Large fire events will continue to serve as reminders.

How do we move beyond the smoke and mirrors? The time for solutions is now. Through a collaborative process, in a landscape context, prioritized treatments to reduce risk and restore ecosystems must occur. It's time for all concerned to agree on principles that guide land-management actions and to implement planned actions. We have the evidence to make reasonable decisions.

Is the problem solved? Almost. Policy in transition also takes time. Collaboration isn't easy. Relationships, adjusted for new thinking, with the resolve to move forward, have to be developed. With the issue of wildfire, time isn't on our side. Bold steps are necessary, tempered by respect for all involved. National and state leadership has done their part. It's time for professional land managers, stakeholders and citizens to act.

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Interjurisdictional Fisheries Management: Better Data—Better Decisions

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Introduction

Fisheries scientists continue to develop and improve models that describe how fishing activities affect target and non-target resources. Models are now available that incorporate a variety of environmental factors that account for multi-species interactions, predator-prey relationships, by-catch of nontarget species and other components of human interactions with our marine resources. Social scientists are modeling the impacts of the changing status of the resource and subsequent changes in regulations on fishers and communities, communities that support them and are supported by them. These modeling efforts must continue if sound decisions are to be made in the management of our marine fishery resources.

The most limiting factor in the ability of managers to make the best management and policy decisions based on critical analyses and modeling efforts, is the lack of adequate data on habitat quality. Significant progress already has been made in the development of regional fisheries data collection programs through national Oceanic and Atmospheric Administration (NOAA) Fisheries' partnerships with the states, and the Pacific, Gulf and Atlantic Interstate Marine Fisheries Commissions (ISMFCs). But, further work is needed. NOAA Fisheries and our state and territorial management partners must move forward together to identify all biological and socioeconomic data needs, to establish relative priorities for the collection of these data, and to determine the most effective and efficient means of collection. In addition, development of systems with which to access and utilize these data must keep pace with the increased complexity of the information that is collected.

Interjurisdictional Fisheries Management Partners

NOAA Fisheries is responsible for the management of 904 exploited marine fish and invertebrate species within the 3.4 million square nautical miles

of our nation's exclusive economic zone (EEZ), which extends from the 3-mile state waters boundary to 200 nautical miles from shore (National Research Council 2002). However, NOAA Fisheries is also responsible for supporting the interjurisdictional management of marine fishery resources that are found predominantly within the waters of coastal states or territories.

Fishery Management Councils

Under the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), eight regional fishery management councils (FMCs) work closely with NOAA Fisheries, in the development of fishery management plans (FMPs) that the agency then implements to manage the fisheries of the EEZ. The FMCs are made of representatives from the state fishery agencies and interested stakeholders and citizens that may represent commercial or recreational sectors of the industry, environmental groups or academia, as well as federal representatives from NOAA Fisheries and U.S. Fish and Wildlife Service (USFWS).

Interstate Marine Fisheries Commissions

NOAA Fisheries works closely with the Atlantic States Marine Fisheries Commission (ASMFC), its 17 Atlantic coastal member states (the District of Columbia and the Potomac River Fisheries Commission are considered states) and the USFWS, to implement the Atlantic Coastal Fishery Cooperative Management Act (ACFCMA). NOAA Fisheries also participates in its interstate fisheries management process, and it provides scientific and technical support to the ASMFC, the Gulf States Marine Fisheries Commission (GSMFC) and the Pacific States Marine Fisheries Commission (PSMFC) on a variety of fishery research, monitoring and enforcement programs within each commission's jurisdiction.

States

Individual states are responsible for the management of the fisheries within their own waters. States participate in the FMC and the ISMFC processes, cooperating with adjacent states and federal fisheries agencies to ensure that interjurisdictional fishery resources are managed consistently throughout their ranges.

Fisheries Data

The availability of adequate, accurate data is the foundation of sound scientific advice that allows for effective and efficient natural resource management. Without an understanding of data needs and the means to obtain those data, resource managers are handicapped in their ability to provide for the long-term sustainability of our marine resources. In addition, good data provide the means to evaluate the effectiveness of resource managers in meeting-stated conservation and management goals and objectives.

Data Needs

In order to understand the impacts of fishing activities on marine fish populations, we must first know what those activities are. Data must be collected on the amount of fish removed from the populations; these removals, or the catch, include both landings and dead discards. We need to know the amounts of effort that affect those removals, and we need to know the changes in both removals and in effort, over time. These fisheries-dependent data are also used to track trends in the relation between catch and effort to provide a first indication of fishing's impact on fish populations.

Beyond catch and effort, biological data are also needed to understand the impacts of fishing on the structures of populations that interact with the fisheries. This data determines if a population's age or size structure changed, the number of large fish observed in the catch or the lower proportions of young fish seen compared to those in the past. They also determine if the ratio of males to females changed, if one sex is targeted more frequently than the other, the reasons for preference and if the proportion of the various species found in the area of a fishery changed over time. Data to address these questions are obtained both from the fishery, as catches are landed or with at-sea sampling by onboard observers, and from fishery independent sampling programs, such as those based on research vessel surveys.

Fishery managers must also understand the benefits, economic and social, of a fishery resource to the communities associated with that resource. Several questions should be addressed. Do communities rely on the harvest and processing of that resource for their economic survival? Does the local culture depend on the continuation of fishing to maintain a way of life? How does the status of the resource impact the profitability of a fishery? On the other hand, does

the fishing activity result in environmental or other changes that impact the socioeconomics of an area? Are coastal fish stocks reduced to the point that recreational fishers no longer travel to the area to fish? Are prey species removed or habitats destroyed resulting in declines in other resources, such as migratory birds, that contribute to local tourism?

Key elements to data needs include: estimates of total removals from the populations; effort expended in the removal process; size, age, sex and species composition of the populations and of those individuals removed from the populations; value of the harvest, at the time of landing and through processing to consumption; numbers of individuals that rely on the resource for their livelihood; and costs associated with the product, from harvest to the final sale. Meeting these data needs is often time consuming and expensive, and partners at the state, regional and national levels must work together to develop effective and efficient data collection and management systems. In addition, the National Research Council (2000) stated that NOAA Fisheries should work cooperatively with industry in order to create an industry environment that encourages the accurate and precise reporting necessary for improvements in data quality.

Data Programs

Numerous programs have existed for the collection of data related to our marine fisheries. NOAA Fisheries has long had regional programs: to collect biological, catch and effort data from fishing vessels at the dock and at sea; to collect landings and value data from dealers and processors; to collect biological, environmental and oceanographic data from research vessel surveys; and to collect economic, sociological and anthropological data and information through various studies and sampling programs.

The ISMFC have maintained regional data management systems for their member states and have supported various data collection programs that are implemented by the states. The ASMFC, in conjunction with its member states, NOAA Fisheries and the USFWS, has created the Atlantic Coastal Cooperative Statistics Program (ACCSF) to provide a single, regional data repository with specific data collection and reporting standards agreed to by all participants. Similarly, the Gulf States Marine Fisheries Commission's (GSMFC) state-federal cooperative program, GulfFIN, provides a mechanism to collect, manage and disseminate statistical data and information on the commercial (ComFIN) and recreational (RecFIN-SE) fisheries of the region. This program works

through the joint efforts of all its partners, including the states and territories of the region, NOAA Fisheries, USFWS, the U.S. National Park Service and the Gulf of Mexico and Caribbean Fishery Management Councils. The Pacific States Marine Fisheries Commission (PSMFC) maintains a data management system, PacFIN, for its member states. Commercial fisheries data collection programs in California, Oregon, Washington and Alaska all include long-standing fishing trip ticket systems. However, the program does not currently link detailed information about the trip, such as sample biological data, gear used, or effort. In addition, Alaska Fisheries Information Network (AKFIN)—a cooperative venture of the PSMFC, Alaska Department of Fish and Game, Commercial Fisheries Entry Commission, NOAA Fisheries and North Pacific Fisheries Management Council—supports collection, entry, transfer, analysis and management of Alaska fishery information.

Individual states maintain significant data collection and monitoring programs within their own waters and across interjurisdictional boundaries as they work on single and multi-state projects funded with state revenues and with funds from various federal grant programs. Under the ACFCMA, NOAA Fisheries provides funding to the ASMFC, its 17 Atlantic coastal member states, and the USFWS, to support the ASMFC interstate fisheries management program. These funds are used for: fisheries management planning; state cooperation in collection, management and reporting of fisheries data; fisheries research; fisheries law enforcement; and habitat conservation (National Marine Fisheries Service 2001).

Under the Interjurisdictional Fisheries Act, NOAA Fisheries provides funding to the three Interstate Marine Fishery Commissions and to 38 states and territories for monitoring, data collection and fishery research programs that support management of multijurisdictional fisheries (U.S. Department of Commerce 2000). Under the Anadromous Fish Conservation Act, NOAA Fisheries has provided support to 29 states and 2 commissions for projects conducted for the conservation, development and enhancement of anadromous fishery resources (those that migrate from salt to fresh water for spawning), including similar species in the Great Lakes and in Lake Champlain (U.S. Department of Commerce 2000). Many projects funded under this program are critical elements of larger multifunded programs to manage, restore or enhance U.S. anadromous species, such as Pacific and Atlantic salmon, Atlantic and shortnose sturgeon, American Shad, and river herrings.

Recreational fisheries also contribute significantly to the overall removal of fish from their populations. They require special sampling programs to obtain the data necessary to estimate the volume of those removals and to evaluate the socioeconomic impacts to those involved in the fishery. The Animal Marine Recreational Fishery Statistics Survey (MRFSS) program has been sponsored by NOAA Fisheries, since 1979. This survey, which includes both dockside sampling and telephone interviews, providing estimates of catch and effort by species, state, mode (e.g., from the beach or by boat) and fishing area. The MRFSS provides estimates for the Atlantic, Pacific, Gulf of Mexico, Western Pacific and Caribbean areas, based on a uniform statistically designed methodology that has been consistently implemented across areas and years (NMFS 1998). All coastal states, except Alaska, have contributed to this program to answer state recreational data needs, by either active participation in conducting sampling, or by supporting increased sampling to address specific questions relevant to their local fisheries. As the management needs of the states change relative to recreational fisheries, NOAA Fisheries works with the states to identify modifications and supplemental sampling protocols that address those needs while maintaining the statistical integrity of the sampling program.

Fisheries independent data collection programs compliment the fisheries dependent programs described above, at the state, interstate and federal levels. Research vessel surveys, special collection programs and other activities provide information about marine fish populations that cannot be obtained from fisheries that tend to select for particular species or size categories. Most of these data have not been incorporated into the regional data management systems at this time.

Data Inadequacies

Despite improvements and expansions in marine fisheries data collection and data management systems, the independent state, regional or national data management systems have been inefficient at providing needed data in the timely fashion required for effective fisheries management (National Research Council 2002). Data are often incomplete or inaccurate. Data are sometimes collected in an inconsistent manner, sampling protocols are not established or are not followed, and errors in calibration of collection equipment are not quickly or adequately addressed. Data, distributed over numerous management systems, are often inaccessible to those who need it or are in formats that do not support needed analyses. Collection methods are often complex, inefficient and

burdensome to those who provide the data. Individual data collection programs are often limited in scope, and, as a result, multiple programs are required to meet fishery management needs. Fisheries independent data are not easily linked with fisheries dependent data sets, so comparisons of fish populations with what is seen in the harvest is not straightforward.

A Fisheries Data Management Solution?

Congress addressed marine fisheries data management inefficiencies when it reauthorized the MSFCMA, in 1996, by requiring NOAA Fisheries to develop recommendations for implementation of a standard fisheries information management system to improve the state of our fisheries statistics programs. Each of the interjurisdictional fisheries partners has been working to develop and implement this new, integrated fisheries information system (FIS) (National Marine Fisheries Service 1998). As portions of the system come on-line, the ability to answer to fisheries management questions will be improved, both in timeliness and in adequacy of analyses. The FIS will provide the foundation for fishery-dependent data collection and information management systems, nationwide. The FIS focuses on a state, regional and national partnership that utilizes existing data management systems, with possible modifications, to create the needed linkages between and among the regional and national systems. The FIS is not intended to replace existing successful data management systems, but instead, to identify means to improve or build upon them (National Marine Fisheries Service 1998). The FIS will eventually make fisheries-dependent data available to a wide range of potential users, including fishery management council and commission staffs, fisheries scientists and managers, the fishing industry, academia, and members the public.

Under the FIS, each region will maintain central repositories of data, which will serve as the regional information management system (e.g., GulfFIN, ACCSP, PacFIN). The NRC identified the Atlantic coast's ACCSP as a good model for these regional data management systems because ACCSP identified a core data set and requires inclusion of all the necessary data in a single database that is available to all partners, with no one partner having absolute control of that data (National Research Council 2000).

In addition to providing consistent, reliable data at the regional level, the FIS, when fully implemented, will further reconcile and standardize the data as the regional data are extracted from their data management systems and

summarized to develop national or interregional reports. This will help to reduce regional differences and provide data that are more consistent and understandable to the users.

Conclusion

Marine fishery managers and their science advisors recognize that adequate data of known quality are needed for the fishery management process to work to the benefit of the nation and the sustainability of the resource. These data are expensive to obtain and require complex systems to manage. To meet the future needs of fisheries management, fishery dependent and fishery independent sampling protocols must be evaluated to ensure that data used in development of fisheries management advice are accurate and are based on recognized standards for data collection. Obtaining and managing data effectively and efficiently requires that all partners in the management of our interjurisdictional marine resources work cooperatively in the design and implementation of needed data collection and management systems. Marine fisheries management partners also must be prepared to modify and improve those systems as advancements in knowledge and technology are realized.

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Double-crested Cormorant Impacts to Fisheries Resources in New York: Science-based Evaluations That Refute a Natural Resource Dogma

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Introduction

During the past 25 years, double-crested cormorant (*Phalacrocorax auritus*) numbers have increased dramatically in the North American Great Lakes Region (Wesloh et al. 2002). In New York, the increased numbers of

double-crested cormorants (cormorants) are particularly evident in the eastern basin of Lake Ontario (Eastern Basin) and on Oneida Lake. Concurrent with the increasing numbers of cormorants were reductions in the recreational fisheries on these two waters.

The Eastern Basin encompasses New York waters of Lake Ontario from 4.3 miles (7 km) south of Little Galloo Island to Cape Vincent and provides important recreational fisheries for smallmouth bass (*Micropterus dolomieu*), yellow perch (*Perca flavescens*), walleye (*Stizostedion vitreum*), lake trout (*Salvelinus namaycush*) and brown trout (*Salmo trutta*). The primary Eastern Basin cormorant nesting colony is Little Galloo Island where nesting pairs of cormorants increased from 22 in 1974, peaked at 8,410 in 1996, and have stabilized between 5,000 and 5,700 nests through 2002 (Wesloh et al. 2002, Farquhar et al. 2002). Since 1994, nest removal has been used on surrounding islands to restrict cormorant nesting to Little Galloo Island (Farquhar et al. 2002). Beginning in 1999, all cormorant nests that could be reached from the ground on Little Galloo Island were treated with pure, food-grade, corn oil to reduce nest productivity success (Farquhar et al. 2002). Nest productivity success has been reduced by approximately 95 percent in each year of egg oiling treatments (Farquhar et al. 2002).

Oneida Lake is a 51,000-acre (207 km²), productive, shallow lake in central New York (Mills et al. 1978) that supports important recreational fisheries for walleye and yellow perch (Connelly and Brown 1991, Connelly et al. 1997). On Oneida Lake, the number of nesting pairs of cormorants increased from two in 1984 (Claypoole 1988) to more than 360 by 2000 (Coleman and Richmond 2000). Concurrent with the increased number of cormorants has been a decline in adult stocks of both walleye and yellow perch to approximately one-third of the average from previous decades (VanDeValk et al. 2001). Beginning in 1998, the number of successful nests (nests producing cormorant chicks) was reduced to approximately 100 per year. Oneida Lake serves as a fall staging area for migrating cormorants with 1,000 to 2,000 migrants regularly observed from the middle of August through the middle of October (VanDeValk et al. 2002, Coleman and Richmond 2000). Beginning in 1998, a fall harassment program (commencing the first week of September and continuing for approximately one month) has been conducted annually to alleviate the build-up of cormorants and to reduce their predation effects.

New York State Department of Environmental Conservation (NYSDEC) actions to investigate cormorant diet and consumption, fishery

decline, and cormorant management activities were conducted because of resource managers' concerns for the long-term health of the fisheries and because of the strongly-held, public perception that smallmouth bass (in the Eastern Basin), walleye (in Oneida Lake) and yellow perch (in both waters) fishing was poor due to cormorant predation. To assess the impact of cormorant predation on these fisheries, NYSDEC, United States Geological Service (USGS), and Cornell University (CU) researchers undertook studies to evaluate the magnitude of cormorant predation and the impacts of cormorant predation relative to other factors that may have contributed to the decline in these fisheries. Cormorant predation was compared to angler harvest, commercial harvest (in the Eastern Basin) and ecological changes (such as phosphorus input reductions, forage fish abundance changes, dreissinid mussel increases and water clarity increases) to estimate the relative importance of these factors in fish population and fishery reductions.

The existence of long-term data sets for Eastern Basin (26 years) and Oneida Lake (40 years) proved essential in evaluating the impacts of cormorant predation on the fisheries resources of these waters. Since 1976, warm water fish stocks of Lake Ontario and Eastern Basin have been consistently monitored for their relative abundance, with particular emphasis on smallmouth bass, walleye, yellow perch and white perch (*Morone americana*) (Eckert 2002). Since 1961, walleye and yellow perch in Oneida Lake have been monitored as larvae, juveniles and adults (Mills and Forney 1988, Mayer et al. 2000, Rudstam et al. in press).

Eastern Basin

Fish Population and Fishery Trends

In 1998, NYSDEC and USGS undertook an evaluation of the impact of cormorant predation on smallmouth bass and other fishes of the Eastern Basin in response to public concerns and as a follow-up to information that confirmed warm water fish stocks in the Eastern Basin had declined, and cormorants were consuming large numbers of fish (Eckert 1998, Ross and Johnson 1999). But, there was no conclusive evidence at that time to link cormorants to the decline in smallmouth bass. Other ecological changes (e.g. nutrient reductions, alewife [*Alosa pseudohorngus*] population changes, dreissinid mussel expansion and increased water clarity) that occurred during the same period may have

contributed to the decline in the smallmouth bass population. Although cormorants consumed large numbers of smallmouth bass and yellow perch, if they primarily consumed small, young-of-year fish, little impact to the fishery populations would be expected. The 1998 (and subsequent) studies assessed trends in the quality of the Eastern Basin warm water fishery; it also described the sizes, ages and numbers of smallmouth bass and yellow perch consumed by cormorants; it evaluated the influence of ecosystem changes on smallmouth bass fisheries and determined that cormorant predation represented a significant factor in the decline of the smallmouth bass and yellow perch populations and fishery of the Eastern Basin (Lantry et al. 2002, Burnett et al. 2002).

As measured in the warm water fisheries assessment program, an overall decline in the warm water fish community was found. There were between 200 to 250 fish per net gang from 1976–1979 to approximately 20 fish per net gang from 1995 to 2001 (Eckert 1999a, Eckert 2002). Most species that were abundant at the start of the assessment program have declined over this 26-year period. Smallmouth bass are an important component of the Eastern Basin fish community, and the most commonly sought species in the recreational fishery (McCullough and Einhouse 1999); however, this species has substantially declined in abundance with recent measurements less than 20 percent of historical measures (Eckert 2002). In six of the last seven years, measured abundance (mean number caught per net) of smallmouth bass was less than in any previously recorded year (Eckert 2002). Yellow perch stocks remain low, despite recent improvements in reproductive success (Eckert 1999c, O’Gorman and Burnett 2001, Eckert 2002).

An examination of the abundance, age, growth and mortality of smallmouth bass in the Eastern Basin from 1976 to 1997 documented a substantial decline in smallmouth bass relative abundance beginning in 1991, with no significant change in survival for ages 6 to 12 over this time period (Chrisman and Eckert 1999). Growth rates of smallmouth bass ages 6 to 10 increased over this time period suggesting that Eastern Basin smallmouth bass were not resource limited, despite declines in lake productivity (Chrisman and Eckert 1999). Mortality of younger smallmouth bass increased, as shown by a shift in the modal age group in catch curves, and there was a failure of strong year classes (as measured at age-3) to make a significant contribution to the fishery once they reached age-6 (Chrisman and Eckert 1999).

A 1998 creel survey found the quality of the Eastern Basin smallmouth bass fishery had deteriorated to one of the lowest levels on record. McCullough

and Einhouse (1999) reported that 36,000 smallmouth bass were harvested by anglers in 1998, which was substantially lower than the 183,000 and 90,000 smallmouth bass harvested in the Eastern Basin during 1978 and 1984, respectively. Angling quality, as measured by catch per unit of effort (CPUE), was one-half or less that measured in previous studies (Panek 1981, Anonymous 1989).

To compare changes in the success of Eastern Basin smallmouth bass anglers to other areas in Lake Ontario, Eckert (1999b) used the ratio of area-specific harvest rate to lake-wide harvest rate in the smallmouth bass fishery of Lake Ontario from 1985 to 1998. He found a significant decline in the harvest rate ratio at the Eastern Basin site, beginning in the early 1990s. He found no significant lake-wide trend in smallmouth bass harvest rate at other sites which indicated that changes in nutrients, alewife abundance and dreissenid densities throughout Lake Ontario were not primary influences in Eastern Basin smallmouth bass fishery reductions. These findings were similar to that observed in Lake Erie, where smallmouth bass populations seem to have benefitted from nutrient reductions, dreissenid mussel expansion and increased water clarity (W. Culligan, personal communication 2002).

Based on relative abundance measures in the warm water assessment, a significant decline in yellow perch abundance has occurred since the mid-1980s (Eckert 1999c, Eckert 2002). No increase in mortality of yellow perch age-5 and older or significant changes in growth rate were found (Eckert 1999c). Annual mortality rate of yellow perch age-2 to age-5 doubled from 1992 to 1995, compared to 1980 to 1983, and was positively correlated with piscivore (cormorant and walleye) abundance (O’Gorman and Burnett 2001).

Cormorant Consumption

The diet of cormorants on Little Galloo Island has been quantified since 1992 and at two other Eastern Basin cormorant colonies (Pigeon Island and Snake Island) since 1999 (Johnson et al. 2002a, Johnson et al. 2002b, Johnson et al. 2002c). On Little Galloo Island, annual fish consumption by cormorants averaged 32.8 million fish and 3.1 million pounds from 1992 to 2000 (Johnson et al. 2002a). During this nine-year period, an estimated 295 million fish were consumed, including 93 million alewife, 73 million yellow perch and 11 million smallmouth bass (Johnson et al. 2002a). Cormorants consumed an estimated 167,200 pounds (77,000 kg) of smallmouth bass in 1998—approximately three

times the weight of smallmouth bass harvested in the sport fishery (Johnson et al 2002a). From 1993 to 2000, cormorant consumption of yellow perch ranged from 183,000 pounds (83,100 kg) to 904,000 pounds (410,800 kg) compared to the commercial fishery harvest of 21,000 pounds (9600 kg) to 63,000 pounds (28,500 kg) (Johnson et al. 2002a).

If smallmouth bass and yellow perch consumed by cormorants were primarily young-of-year fish, then population-level impacts would be minimal and masked by compensatory mechanisms. Cormorant consumed yellow perch 2 to 9.3 inches (59–236 mm) total length that were mostly age-1 (48%), age-2 (20%) and age-3 (20%) (Burnett et al. 2002). From 1993 to 1994, the estimated mean total length of smallmouth bass consumed by double-crested cormorants was 10.1 inches (259 mm), and these fish averaged 4.4 years of age (Adams et al. 1999). Adams et al. (1999) also estimated that 14 percent of smallmouth bass consumed by cormorants from 1993 to 1994 could legally be harvested by anglers (greater than or equal to 12 inches (305 mm) total length). In 1998, Eastern Basin smallmouth bass consumed by cormorants averaged 7.9 inches (200 mm) total length and 3.3 years of age (Schneider and Adams 1999). The smaller sizes and younger ages of smallmouth bass consumed by cormorants in 1998 compared to 1993 to 1994 were attributed to what was available in the population, i.e., a greater proportion of smaller, younger smallmouth bass in 1998 due to an abundance 1995 cohort of smallmouth bass. Johnson et al. (2002a) found smallmouth bass consumed by cormorants during the 1993 to 2000 pre-chick feeding periods averaged 8.4 inches (214 mm) total length and noted a reduction in the size of smallmouth bass consumed through the prechick, chick and postchick feeding periods.

Linking Cormorant Predation and Fishery Declines

To evaluate trends in mortality of young (ages 3 to 6) smallmouth bass, Lantry et al. (2002) used the ratio of CPUE at age-3 to CPUE at age-6 of smallmouth bass as an index of relative mortality. They found a significant difference in relative mortality of smallmouth bass between ages 3 and 6 for 1975 to 1988 and 1989 to 1996. Mortality increased substantially after 1988 when the number of cormorant nests on Little Galloo Island exceeded 3,500 (Lantry et al. 2002). For 1988 to 1994, the relative mortality of smallmouth bass from age-3 to age-6 was related to the number of cormorant nests on Little Galloo Island (Lantry et al. 2002). Using diet composition (sizes and ages) of smallmouth bass

consumed by cormorants, the 1992 to 1996 smallmouth bass consumption mean (600,000 fish) and estimates of smallmouth bass standing stock for Eastern Basin, Lantry et al. (2002) calculated that, at the observed post-1988 level of abundance on Little Galloo Island, cormorants had the potential to remove a major portion of each smallmouth bass year class.

To evaluate cormorants as a significant source of mortality on yellow perch stocks, Burnett et al. (2002) compared size- and age-specific diet information and estimates of cormorant consumption to expected levels of yellow perch populations. Little Galloo Island cormorants could consume 54 percent of age-3 yellow perch at the population level expected to be present in the Eastern Basin and could remove a substantial portion of the overall yellow perch stock (Burnett et al. 2002).

Oneida Lake

Fish Population and Fishery Trends

Abundance of adult walleye and yellow perch declined significantly through the 1990s to 40 percent and 29 percent, respectively, of their long-term (1957–1990) means (Rudstam et al. in press). Total annual mortality for adult walleye (1995–2001) was similar to the long-term (1964–1990) average of 25 percent, and total annual mortality for adult yellow perch was not significantly higher than the long-term average of 31 percent (Rudstam et al.).

In Oneida Lake, various compensatory mechanisms that affect early survival of walleye and yellow perch occur by age-1 and little additional mortality is expected until fish reach the size sought by anglers (Forney 1980, Nielsen 1980). Prior to 1990, the index of age-1 walleye and yellow perch was correlated with the subsequent recruitment of that year class to age-4 (walleye) and age-3 (yellow perch); however, over the past decade, this relationship has failed to hold up. Measured abundance of cohort strength (relative abundance of age-1 fish) was not significantly different in the 1990s compared to the long-term measures for walleye (1961–1989) or yellow perch (1965–1989), which should result in relatively stable (as opposed to the observed declining) fish populations. Apparently, mortality of age-1 to age-3 yellow perch and age-1 to age-4 walleye increased during the 1990s, compared to the previous two decades.

During the 1990s, several system-wide changes that can affect fish populations, have also occurred in Oneida Lake, including the introduction of

zebra mussels, the associated increase in water clarity, the continuing declines in nutrient loading rates and the associated decrease in total phosphorus concentrations (Rutherford et al. 1999; Mayer et al. 2000, 2001; Idrisi et al. 2001). Reduced nutrient loading and zebra mussel expansion should lower abundance and productivity of zooplankton and benthic invertebrates, resulting in lower growth rates of walleye and yellow perch. To date, declines in zooplankton, benthic invertebrates, or walleye and yellow perch growth rates have not been measured (Rutherford et al. 1999; Mayer et al. 2000, 2001; Idrisi et al. 2001) indicating that other system-wide changes (i.e., cormorant predation) have increased mortality of subadult yellow perch and walleye.

Cormorant Consumption

Total consumption of fish by cormorants increased from 97,000 pounds in 1995 to 161,000 pounds in 1996 and 172,000 pounds in 1997. Efforts to limit nesting success and to force birds from the lake decreased total annual consumption to 103,000 to 125,000 pounds from 1998 to 2000.

Yellow perch were the dominant prey of the cormorant (both by mass and by number) in all seasons and walleye were common in cormorant diet samples. Together, these two percids represented 57 to 77 percent of the cormorant diet by mass and 40 to 81 percent by number. At least 12 other fish species were identified as consumed by Oneida Lake cormorants.

In 1997, it was estimated that cormorants consumed 49 percent of age-1, 26 percent of age-2 and 13 percent of age-3 or older yellow perch that were present in Oneida Lake (VanDeValk et al. 2002). During this same year it was estimated that cormorants consumed 7 percent of age-2 and 7 percent of age-3 walleye that were present (VanDeValk et al. 2002). The size groups of these fish correspond to the sizes selected by cormorants from the Eastern Basin (Adams et al. 1999, Burnett et al. 2002)

VanDeValk et al. (2002) compared angler harvest and cormorant consumption of yellow perch and walleye in Oneida Lake in 1997 and showed that cormorant predation was comparable to angler harvest of adult yellow perch. They found that angler harvest was the dominant source of mortality of adult walleye (14%), but that cormorants were a larger source of mortality of subadults of both species (age-1 and 2 yellow perch and age-1, 2 and 3 walleye) than were anglers.

Linking Cormorant Predation and Fishery Declines

Rudstam et al. (in press) used the long-term relationship between age-1 measured abundance and adult abundance (age-4 walleye and age-3 yellow perch) that was established prior to 1990 and the age-1 abundance measured since 1989 to predict the number of adult percids that should have been present (adult recruitment) in the absence of cormorant predation. They compared this predicted adult recruitment to the sum of observed recruitment and estimated cormorant consumption of sub-adult fish for eight year classes of fish (three walleye and five yellow perch year classes) and found the predicted recruitment was within 20 percent of this observed-consumption sum for four of the year classes (one walleye and three yellow perch year classes). Predicted recruitment of the other year classes was higher than the observed-consumed sum in three cases and lower in two cases. The increase in cormorants is the most likely ecosystem change to have caused the increased mortality of subadults in Oneida Lake, since these size groups are selected by cormorants (Adams et al. 1999, Burnett et al. 2002, VanDeValk et al. 2002), and the number of subadult fish from a year class consumed by cormorants is similar to the number of fish predicted to recruit but never observed to reach adult age. To date, no other potential source for increased mortality of subadult percids has been identified. Anglers harvest some age-2 perch; although, the number was an order of magnitude lower (33,000) than the numbers taken by cormorants (more than 300,000) in 1997 (VanDeValk et al. 2002). The number of adult walleye has declined, adult walleye rarely consume fish older than age-1, and the age-1 fish consumed by walleye are generally taken in the spring and summer prior to age-1 index of year class strength (Forney 1980, Nielsen 1980, VanDeValk and Rudstam 1997).

Summary

The scientific analysis of available data provides strong evidence that cormorant predation on smallmouth bass and yellow perch in the eastern basin of Lake Ontario and walleye and yellow perch in Oneida Lake is a major factor contributing to the decline of these fish stocks. Smallmouth bass angling quality had declined in the Eastern Basin while it remained unchanged or improved in other areas of Lake Ontario that were outside the foraging range of the Little Galloo Island colony; cormorants consumed smallmouth bass, yellow perch and walleye at sizes (ages) subsequent to compensatory mechanism influences and

just prior to entering the fishery; cormorant consumption of yellow perch (Eastern Basin and Oneida Lake) and smallmouth bass (Eastern Basin) is significantly greater than angler harvest, and cormorant consumption is significantly greater than the commercial harvest of Eastern Basin yellow perch. Numbers of yellow perch and walleye consumed by cormorants in Oneida Lake are on par with the reductions in recruitment of these percid to the adult stock.

Our ability to detect and assess the impacts of cormorant predation on the Eastern Basin and Oneida Lake fish populations was only possible due to the availability of long-term, high-quality data. This type of data is not available for most aquatic systems, is expensive to collect and maintain but proves extremely valuable in assessing changes and in quantifying factors responsible for the changes.

In the case of cormorant predation on fish stocks, the challenge to resource managers remains in the allocation of the fisheries resources and to balance anglers and angler-interests with cormorants and cormorant-interests.

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A Study of Science and Policy for Grizzly Bears and Wolves

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Introduction

Grizzly bear and wolf management in Idaho provide ample material for studying science in conservation policy. I have chosen a case study for each species. These cases confirm that science, policy and politics influence each other interdependently. This confirms that to use science, decision makers must use judgment. They cannot avoid reaching beyond facts and rules in order to decide, and they cannot claim special ability in doing so. Anyone can do this, many people want to and it is within our ability to allow more involvement in using judgment. Therefore, I conclude the study by suggesting a better way.

I present the case studies below, followed by an analysis and a proposal for improved decision making.

Case 1: Limiting Road Density for Grizzly Bears

When the Idaho Panhandle National Forest began amending its standards for grizzly bear habitat management, it had detailed guidance. The Interagency Grizzly Bear Committee (a federal-state partnership of wildlife and natural resource agencies) had chosen road density as the chief habitat factor and had adopted a pattern for specifying measurable standards.

For each area of grizzly bear habitat averaging 100 square miles (a bear management unit), the U.S. Forest Service was to use a geographic information system (if available) to calculate the length of roads and trails for each square mile. The exact procedure, known as moving window analysis (Turner and Gardner 1991), was automated by software that classified areas by density levels, i.e., a certain area might contain between 1 and 2 miles of roads per square mile, and another area might contain greater than 2 miles of road per square mile. The size of high-density areas was to be limited in each bear management unit. Limits were to be established for three categories: (1) density of total motorized access

routes (i.e., roads and trails, open and closed), (2) density of open motorized roads and trails, and (3) minimum size of areas with no roads or trails.

The guidance was strong too because the U. S. Fish and Wildlife Service (Service) and the federal courts had designated road density as a deciding factor under the Endangered Species Act. The Service said, in the recovery plan for grizzly bears, that adequate distribution and limited human-caused deaths of bears both depended on road density and traffic levels. The courts had ruled that road density could reach levels high enough to risk violating the Endangered Species Act by significantly modifying habitat and impairing essential behavioral patterns, such as breeding, feeding and sheltering (*Swan View Coalition v. Turner*, 824 F. Supp. 923, 933). This focus on road density rested on scientific observations (later to be published in a refereed journal) showed a likelihood that grizzly bears directed their travels according to where roads and traffic ran (Mace and Manley 1993).

A Previous Solution

Nearby in Montana, the Flathead National Forest (Flathead) had already followed the pattern provided by the Interagency Grizzly Bear Committee and created a standard for road and trail densities. The standard applied uniformly across all bear management units in the entire forest, and managers and stakeholders had already tried applying it.

In the mid-1990s, shortly after the Flathead established its standard, interest groups and individuals began negotiating a restoration project that would bring an entire watershed, composed of two adjacent bear management units, into compliance. The negotiators called their collaborative effort Flathead Common Ground. After a breakthrough among forest businesses, Defenders of Wildlife, Trout Unlimited, the National Wildlife Federation and local motor vehicle recreation interests, the group identified more than 100 miles of road to be obliterated in conjunction with other management actions. However, the consensus plan failed to meet the standard by mere percentage points. The predefined, but somewhat arbitrary, size and shape of one bear management unit, paired with the layout of the road system, made it so the group would either fall short or far overshoot the standard if they closed entire roads at a time. If they closed segments of roads, with dead-ends on steep grades or if they shifted the boundary for the management unit, they could have met the numerical standard. However, dead-ends on slopes were unsafe, and shifting boundaries was not allowed.

A New Solution

After the Montana experience and based on local conditions of the Idaho Panhandle National Forest, managers drafted a different type of standard for Idaho. The Idaho Panhandle National Forest is currently awaiting final concurrence from the Service on a standard that specifies different levels of road density for each bear management unit instead of the same level across all units. The forest supported the decision with specific local facts about habitat quality, distribution of land ownership and recreational development and use (U.S. Department of Agriculture Forest Service 2002). In addition to tailoring levels of road density to each management unit, the forest also changed boundaries for a unit—splitting it—because, like in the Montana experience, attempts to average road density across the somewhat arbitrary size of the original unit was impractical and unnecessary for conservation of grizzly bears. Throughout the analysis of this standard, the Idaho Panhandle National Forest relied on the professional opinion of the biologists most familiar with the area. One of those biologists is an employee of the Idaho Department of Fish and Game, which participated in the analysis under a cooperating agency agreement with the U.S. Forest Service, provided under the National Environmental Policy Act.

This solution, reflecting the judgment of biologists with the U.S. Forest Service and the Idaho Department of Fish and Game, differs from the previous judgment of biologists with the Service. The Service's opinion, published in 2001, states emphatically that road densities above a blanket standard violate the Endangered Species Act (U.S. Fish and Wildlife Service 2001).

Case 2: Limiting Impairment of a Recovered Wolf Population

In November, 1994, the Service created two nonessential experimental populations of wolves in the northern Rocky Mountains (50 CFR 17.84(i)). Their goal in Idaho was, "to reestablish a viable wolf population in central Idaho, one of three wolf recovery areas identified in the Northern Rocky Mountain Wolf Recovery Plan," and they intended that the reintroduction would, "not conflict with existing or anticipated Federal agency actions or traditional public uses of park lands, wilderness areas, or surrounding lands (59 Fed. Reg. 60266).

Livestock interests and elected officials—statewide and local—strongly opposed the program. The Service, attempting to resolve the opposition, acknowledged that wolves would kill livestock and, therefore, ruled that wolves

attacking livestock would be designated as “problem wolves” and could be killed according to certain conditions and procedures (50 CFR 17.84(i)(3)(vii)). The Service also noted the concern that the U.S. Forest Service and the U.S. Bureau of Land Management could be pressured to impose precautionary restrictions on permits held by livestock producers who graze on federal land. To allay this worry, the Service made two promises in the rule which stated: “When six or more wolf packs are documented in the experimental population area. . .there would be no land-use restrictions, including areas around den sites or other critical areas” (59 Fed. Reg. 60271); and, “The Service and USDA Animal Damage Control will aid livestock producers by maintaining an effective control program that minimizes livestock losses due to wolves” (59 Fed. Reg. 60275).

Wolves Released and Expected to Grow

The Service adopted this course, expecting that the population would grow despite the killing of problem wolves; in fact, the Service opined that resolving conflicts this way might actually improve the chances for the program’s success. In support of the 1994 rule, the Service reported that, in Montana, “Although 19 wolves have been removed under the control program, the number of wolves has continued to expand in Montana at about 22 percent per year for the past 9 years” (59 Fed. Reg. 60269). Moreover, the plan to kill problem wolves would, in the Service’s analysis, increase, “public acceptance of wolf populations which likely reduces illegal wolf mortality, and allows growth of wolf populations to recovery levels” (U.S. Fish and Wildlife Service 1994:2-13).

The discretion authorizing lethal means of controlling wolves is provided directly in the Endangered Species Act. The relevant section and paragraph of the law explicitly provides that individual animals designated as endangered could be transferred to the threatened list for flexibility in management (16 U.S.C. §1539(j)(2)(C)).

The Service’s confidence in the plan was quickly justified. Following reintroduction, from 1996 forward, the minimum year-end estimates of the population size grew annually at an average rate greater than 30 percent (see U.S. Fish and Wildlife Service 2002).

Wolves Recovered but Still Impaired?

In October 2001, as more than 260 wolves roamed the 20,000-square-mile experimental area, and nearly 600 wolves spread throughout the entire recovery

area (more than 325,000 square miles), interest groups filed suit against the U.S. Forest Service and the Service in the Sawtooth National Recreation Area (Figure 1). The plaintiffs opposed the policy of killing wolves and found a legal basis to challenge it, arguing that the U.S. Forest Service had failed to do the requisite analysis to determine whether grazing was kept within limits imposed by the organic act of the recreation area and whether grazing posed a harm to wolves by tempting them to kill stock, thereby ensuring their own death.

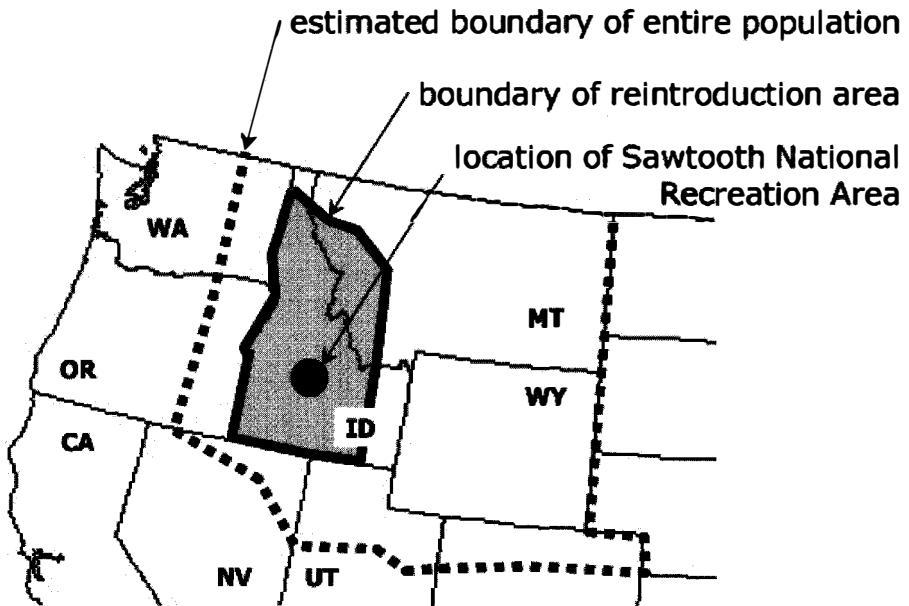


Figure 1. Idaho vicinity, including approximate areas of northern Rocky Mountain gray wolf population (approximately 325,000 square miles), central Idaho experimental gray wolf area (approximately 20,000 square miles) and Sawtooth National Recreation Area (approximately 1,200 square miles).

As the judge described the connection: “The Organic Act [of the recreation area] provides that grazing must not substantially impair the gray wolf population, while the [wolf reintroduction program] provides that wolves will generally be removed if they cause conflicts with livestock” (Winmill 2002:9).

The political message that the plaintiffs objected to the killing of wolves was clear. The suit had followed the killing of two problem wolves earlier that summer by the management team. Such killing had become routine since the first reintroduction in 1995.

The biological irrelevance of the suit was as clear as its political message. One month after the lawsuit was filed, arguing that wolves might be impaired, the Service described the wolf population as recovered under the Endangered Species Act. A breeding pair of wolves near McCall, Idaho, represented the 30th such pair in the entire recovery area of Idaho, Wyoming, Montana and neighboring states, surrounding not only the 1,200-square-mile Sawtooth National Recreation Area, but also the central Idaho experimental population area, more than 16 times the former's size (Figure 1). The Service announced that if at least these 30 breeding pairs persisted in the recovery area for three years, then the Service would declare the recovery of the wolf in the northern Rocky Mountains complete. At that point, the Service would remove the wolf entirely from protection under the Endangered Species Act, having no concern due to impairment of habitat or range, number of wolves killed, disease or predation, inadequate regulations, or, "other natural or manmade factors affecting its continued existence" (16 U.S.C. 1533(a)(1)).

The findings of the Service, legally, did not change the fact that the U.S. Forest Service was derelict in analyzing the use of the recreation area by livestock producers as directed by the National Environmental Policy Act. The lack of this analysis, said the judge, left the question open as to whether the U.S. Forest Service thought wolves were being impaired, regardless of what the Service thought, so the judge enjoined killing of wolves until the U.S. Forest Service finished its analysis and issued a finding.

If the U.S. Forest Service, in completing its analysis, follows the Service, finding that killing wolves allows the population to flourish, the U.S. Forest Service will face pressure in explaining to a federal judge why killing wolves is not impairment. To avoid that pressure, the U.S. Forest Service may decide to find some form of impairment; however, regardless of its answer, the U.S. Forest Service will need time to complete its impairment analysis, and the injunction on killing problem wolves will likely continue in the meantime. This effectively delivers the plaintiffs their victory, strikes the promise to livestock producers that problem wolves will be killed and may result in restrictions on grazing if the judge orders measures to prevent wolves from killing stock.

Analysis: Judgment Is the Heart of the Issue

The interpretation of science in these cases is obvious to participants, and it is also evident in analysis. Stakeholders in grizzly bear management can see that

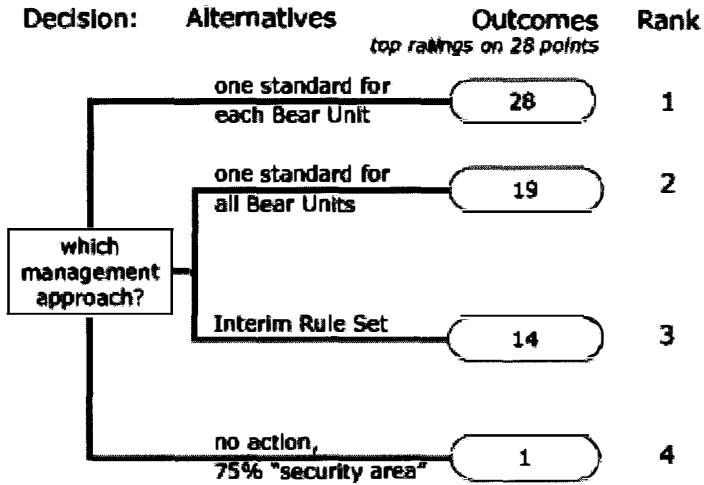
policy to limit road density can be fixed in one place and flexible in another. Policy to allow the killing of wolves can lead to recovery in a three-state region of more than 208 million acres, but it can be enjoined as potentially dangerous to the species in a 756,000-acre patch within that area.

Judgment, not science, is an obvious part of these decisions because the courts test its adequacy. As one judge wrote in a relevant case, agencies trying to prevent harm often lack data “to make a fully informed factual determination [and therefore must] depend to a greater extent upon policy judgments and less upon purely factual analyses” (*Ethyl Corp. v. EPA*, 541 F.2d 27). Courts use the facts behind the decision to test fundamental rationality. Where, “judgment is necessarily more speculative, [courts] will ‘demand adequate reasons and explanations’” (*Ethyl Corp. v. EPA*, 541 F.2d 33). The job of the courts is a, “narrowly defined duty of holding agencies to certain minimal standards of rationality” (*Ethyl Corp. v. EPA*, 541 F.2d 36). Judgment is the focus instead of the facts because technical substance is beyond the expertise of judges; therefore, the courts, “defer to ‘the informed discretion of the responsible federal agencies’” (*Marsh v. Oregon Natural Resources Council*, 490 U.S. 377).

A decision tree can isolate the judgment and technical discretion in these grizzly bear and wolf management cases (Figure 2, Stokey and Zeckhauser 1978). Both cases involved choices among alternatives (U.S. Fish and Wildlife Service 1994, U.S. Department of Agriculture Forest Service 2002), and the diagrams show the alternatives with their expected outcomes and respective values. These are simple trees, assuming one outcome per alternative, but there likely are chances of positive, negative or neutral population growth outcomes for each (i.e., 12 outcomes instead of 4).

Scoring each outcome by rank shows that decision makers consolidated many factors—a strong signal of embedded judgment. The Service described each wolf recovery alternative by the years it would take to achieve recovery and the possible or likely outcomes they foresaw for big game populations, hunter harvest, livestock depredation, land-use restriction, visitor use and economic effects (U.S. Fish and Wildlife Service 1994). After considering these factors for each alternative, the Service identified only their top choice, saying it, “had the highest probability to succeed due to ecological and political considerations” (59 Fed. Reg. 60269). The U. S. Forest Service used 28 points of comparison, only some of which were numeric measures of road density as described above and others, which characterized levels (i.e., high, medium or low) for positive and

(a) grizzly bear management decision tree.



(b) wolf management decision tree.

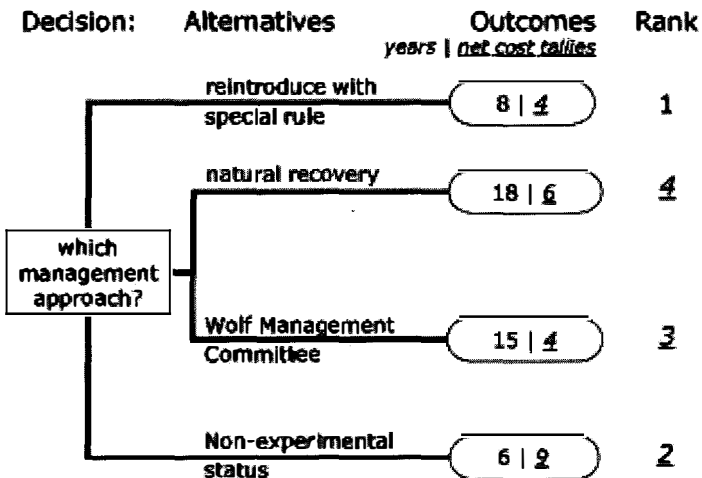


Figure 2. Decision trees for (a) grizzly bear management in northern Idaho and (b) wolf management in central Idaho. Underlined numbers represent calculations of the author for discussion purposes.

negative effects on displacement and birth- and death-rates of grizzly bears. The U.S. Forest Service tallied the number of times an alternative scored as best or second best on these 28 points and used that tally as the value for each alternative (U.S. Department of Agriculture Forest Service 2002:3-23).

No part of the decision tree is completely a positive analysis, such as arithmetic, which would lead all analysts to the same answer based on the same data. All parts contain some normative, value-based elements. Developing alternatives is based on technical proposals of what might work, and those alternatives framed by judgment calls about acceptability. Scoring and ranking can be done multiple ways. Even if decision makers had attempted mathematical predictions of population growth for each alternative, they would have found available data lacking the precision necessary to distinguish between outcomes. Estimates of grizzly bear population growth in northern Idaho range from negative to positive (U.S. Department of Agriculture 2001:20).

These are broad, subjective descriptions of outcomes resulting in simple ordinal values. Anyone versed in the issue can participate in such work. For example, because the Service did not reveal a scoring system, I ranked their outcomes for discussion purposes by tallying the costs and benefits reported for each alternative in table S-4 of the Final Environmental Impact Statement (USFWS 1994: xxii), adding the resulting net cost tallies to the years expected for recovery (Figure 2).

Judgment is not improper, but neither is it universally acceptable. It is influenced by public comments, news media, staff recommendations and the inclinations of the President, cabinet secretary, agency director, other influential people and the decision maker. Because of this, we should consider whether we exercise judgment in conservation in the best possible way.

Proposal: Sharing the Responsibility for Judgment in Science-based Decisions

Any reason for granting a particular person or group the power of judgment can be argued. The power currently resides, and has resided since the founding days of North American conservation, with technically-trained decision makers. There are reasons for this, and there are alternative reasons why technically-trained decision makers should not hold exclusive authority to judge the substantial nontechnical parts of the decision. We should consider more inclusive

decision making because people want to participate. Their help could improve decisions, and only small policy changes would be necessary in order to try.

People Want a Piece of the Action

People have asserted themselves in agency decisions since, at least, the early days of the environmental movement. Rachel Carson's fundamental complaint was that, "flagrant abuses go unchecked in both state and federal agencies," who can, "exercise a ruthless power" (Carson 1962:12). The elements of her proposed solution have become pillars of environmental law. As she suggested, agencies must now provide public access to information and involvement in risk calculations (e.g., the National Environmental Policy Act). Also as she suggested, citizens can protect themselves from agency decisions with legal recourse, such as those provided in the citizen lawsuit provisions of the Endangered Species Act. People began using these laws to assert themselves so quickly and so often in the early 1970s that, by the mid-1980s, leaders of some environmental groups began questioning their effectiveness, saying, "We have won the struggle for acceptance with Main Street America, and now people are looking to us for solutions," and, "It's not enough anymore to stand on the outside and take potshots [through] endless litigation" (Taylor 1990).

Inclusion Improves Decisions

Meaningful involvement improves decisions. For example, in proposing road density standards for grizzly bear management in northern Idaho, the U.S. Forest Service included the state's expertise through a cooperating agency agreement, provided for under the National Environmental Policy Act. This included Idaho in the team that developed and debated the options for management. An even more inclusive team was the collaborative group Flathead Common Ground, which developed recommended management actions for the U.S. Forest Service, such as the details for a formal alternative for consideration.

These options to the current comment-or-litigate approach provide better conservation. As it is today before a decision, the decision maker must consider comments, but can refuse to act on them. After a decision, when defending a lawsuit, the government may negotiate a settlement with the plaintiff and interveners. By long experience with this approach, many participants have the feeling of irrelevance when filing comments; in fact, some have embraced

irrelevance by mass mailing pre-printed postcards to stuff the agency decision maker with the appearance of a landslide vote for the position of an interest group. Other participants have secured exclusive positions in settlement negotiations, exerting minority solutions.

Alternatively, advisory committees, task forces and collaborative groups provide a forum to delve into the complexities, risks and uncertainties of conservation decision making. Deliberation applies facts to goals, unlike public hearings (which are not deliberative) and unlike the results of litigation (which applies facts to law). Unless interested parties can deliberate, conservation fails to benefit from a full range of ingenuity and expertise. Also, the parliamentary procedure of committee action provides for all motions to be heard and, with a second motion, to be debated and, with a majority vote, to be approved. After a full and fair debate and after a decision, the losing side of an issue can either seek votes to revisit the decision or litigate the decision based on fundamentals such as constitutionality or Section 101 of the National Environmental Policy Act (42 U.S.C. 4331). Lawsuits based on dissatisfaction instead of violation would end, and more decisions would be implemented more efficiently.

One Step to Democratic Conservation

With a small but important change, advisory groups, task forces and collaborative groups could provide substantial inclusion in decisions. The Cooperating Agency Agreement, the Resource Advisory Committee and the many other official or informal means of deliberating conservation all stop short of the responsibility to decide on conservation action. They stop short of making decisions because federal conservation law charges cabinet secretaries with these decisions, and secretaries delegate that responsibility to departmental agencies. If the law made a clear option for another step of delegation, then agencies could include state and private partners in the responsibility for making decisions.

The Service, on at least two occasions, has verged on one more step of delegation. In releasing wolves in Idaho, the Service anticipated delegating management of wolves to, “states and tribes under special federal regulations” (U.S. Fish and Wildlife Service 1994:2-4). The Service has also approved the use of a citizen management committee for grizzly bears in Idaho that would provide actual decision making authority to a committee as long, as the committee progressed toward recovery of the bear (65 Fed. Reg. 69624-69643). These

examples fall short of real inclusion because the wolf program would have delegated only the incidental decisions necessary to implement policy, and the Grizzly Bear Citizen Management Committee requires a release of grizzly bears into central Idaho over the objections of all elected Idaho officials.

It would be wise to experiment with inclusive decision making by starting with any of the existing advisory groups. Such groups, especially the formal groups, like the Resource Advisory Committees of the U.S. Bureau of Land Management, operate under established rules of membership, parliamentary procedure and funding. The first change necessary for advisory groups is to provide authority—even if on a limited experimental basis—for the group to make final decisions. Other changes may need to authorize the committee or a companion technical committee to issue the last word on best available science. This would elevate legal challenges from the cat and mouse game of inadequate science to a weightier level, such as the opinion that the committee is impeachable by a relevant professional society (e.g., The Wildlife Society, American Fisheries Society or National Academy of Sciences).

Conclusion

These examples of grizzly bear and wolf management in Idaho show there is an opportunity to improve conservation decision making. We can include nonfederal partners in the authority to decide. This would provide a third means of participation, an additional option before decisions and litigation. The current options have, so far, carried the full weight of people striving to assert their interests in conservation and, therefore, have been overladen and abused. By providing a third option that is designed for debate, we can properly distribute the pressure of decision making and produce more to better conservation.

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When Science, Policy and Politics Don't Mix: The Case of the Missing Lynx

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In the fall 2000, seven state and federal agency biologists unknowingly set in motion a chain of events that has had wide-ranging implications for the profession of wildlife management. It began when the field biologists submitted unauthorized hair samples to a DNA laboratory in connection with the National Interagency Canada Lynx Survey. From this seed grew a multifaceted controversy, fueled by media coverage, conflicting viewpoints, misunderstood motives, miscommunications, and public and political fears of inappropriate agency use of science to control policy on federal lands. Though the initial furor died down, the issue remains unresolved for many wildlife professionals, Congress and the public. We hope to lay the “lynxgate” controversy to rest in this paper by openly addressing the event, discussing it from all perspectives and using it to learn and to grow as a profession.

This paper includes a chronology to clarify the sequence of events that motivated and resulted from the biologists' actions. And, it includes a discussion of the interpretation of the events from the involved parties' viewpoints, including field biologists, research scientists, media, federal and state agencies, Congress, and The Wildlife Society (TWS). Finally, we share our observations and recommendations for avoiding similar problems in the future and for ensuring wildlife biologists and agencies maintain credibility and public confidence in their work.

Chronology

In 1998 the U.S. Forest Service contracted a biologist, Dr. John Weaver, to survey for the presence of Canada lynx (*Lynx canadensis*) in national forests

in Washington and Oregon. The survey was done by attracting lynxes with scent stations, then collecting hair samples they left behind on “scratch pads” fixed to trees (McDaniel et al. 2000). The hair samples were sent to a laboratory in New York for DNA analysis, and the initial results, reported verbally to the U.S. Forest Service, identified some of the samples from both Washington and Oregon as lynx hair. The regional office of the U.S. Forest Service advised the involved forests to consider the lynx presence unverified until Weaver submitted the formal report required by his contract. Additional evidence of lynx was never found in those areas, and reanalysis of the hair samples indicated that they did not come from lynx.

In 1999, the U.S. Forest Service initiated the National Interagency Canada Lynx Survey. The national survey was conducted on a larger scale than the one contracted to Weaver, and it was intended to determine the range of lynx in the lower 48 U.S. states. McKelvey et al. developed the national lynx detection protocol, which required the training of hundreds of field personnel from several agencies to locate, establish, maintain and monitor scent stations and scratch pads, and to prepare, label and submit resultant hair samples to the University of Montana’s laboratory (1999). Mills et al. developed the laboratory protocol, which described the procedure for analyzing the hair samples submitted from the field, distinguishing among the four felid species of northern North America using mtDNA (2000).

The presence and distribution of lynx have been sufficiently determined, based partially on the national survey, for the U.S. Fish and Wildlife Service to classify the lynx as threatened under the Endangered Species Act (ESA). The locations of lynx, when verified by further study, will help guide management actions on public lands to protect and augment lynx populations.

Figure 1 depicts the time-line associated with the lynx study controversy. It is important to know the sequence of these events, in order to understand the situation that unfolded. The controversy revolves around a total of seven biologists, employed by the Washington Department of Fish and Wildlife (WDFW), the U.S. Forest Service and the U.S. Fish and Wildlife Service who submitted, or knew about the submittal of, unauthorized hair samples to a University of Montana laboratory for analysis as part of the National Interagency Canada Lynx Survey. When the media reported the news of these unauthorized submissions in December 2001, Congress and the public questioned the motives of the agency biologists, and, consequently, the internal politics of scientific agencies that influence natural resources policy.

1998	<ul style="list-style-type: none"> • Proposal to federally list Canada lynx • U.S. Fish and Wildlife Service and U.S. Forest Service initiated lynx population inventory, using DNA analysis to identify lynx from hair samples • USFS contracted work with Weaver and Amato in Washington and Oregon
1999	<p>March:</p> <ul style="list-style-type: none"> • Weaver and Amato results reported wider distribution of lynx than previously documented <p>June:</p> <ul style="list-style-type: none"> • USFS questioned Weaver results, voiced concerns about sensitivity and accuracy of DNA analysis <p>July:</p> <ul style="list-style-type: none"> • USFS initiated National Interagency Canada Lynx Survey • National Lynx Detection Protocol written by McKelvey et al. • Univ. of Montana agreed analyze hair samples, using methodology developed by Mills et al. • Field personnel trained in Survey sampling protocol <p>September:</p> <ul style="list-style-type: none"> • Washington Department of Fish and Wildlife (WDFW) employee submitted 3 unauthorized bobcat hair samples to lab, after notifying supervisor (but not principal investigators) • Samples determined to contain insufficient DNA for valid analysis
2000	<p>January:</p> <ul style="list-style-type: none"> • Sampling protocols subjected to external validation by US Fish and Wildlife Service forensics laboratory <p>March:</p> <ul style="list-style-type: none"> • Canada lynx listed as threatened in the lower 48 states <p>June:</p> <ul style="list-style-type: none"> • Mills et al. protocol for identifying lynx based on DNA submitted to journal for publication <p>September:</p> <ul style="list-style-type: none"> • WDFW biologist submitted unauthorized lynx hair sample, after notifying supervisor • Forest Service biologist submitted unauthorized lynx hair sample. Three days later, same biologist informed FS field coordinator for National Survey that sample had been submitted <p>October:</p> <ul style="list-style-type: none"> • Fish and Wildlife Service biologist submitted unauthorized lynx hair sample
2001	<ul style="list-style-type: none"> • Mills et al. DNA laboratory protocol published in peer-reviewed journal, <i>Conservation Genetics</i> <p>February:</p> <ul style="list-style-type: none"> • USFS announced investigation into submittal of unauthorized control samples. Contacted Univ. of Montana lab, notifying principle investigators of unauthorized samples <p>June:</p> <ul style="list-style-type: none"> • Weaver confirmed his 1998 study results were incorrect, due to sample contamination • USFS investigation concluded 7 biologists submitted, or knew about submission of, unauthorized samples, but there was no evidence they intended to defraud the lynx study <p>December:</p> <ul style="list-style-type: none"> • General Accounting Office and Inspector Generals of Department of Agriculture and Department of the Interior asked to investigate unauthorized samples
2002	<p>March:</p> <ul style="list-style-type: none"> • GAO, and USDA and Inspector Generals concluded that the biologists did submit unauthorized samples, but that there was no evidence of criminal intent, and the samples had no negative effect on Lynx Survey or forest management • U.S. House of Representatives Resource Committee hearing on National Lynx Survey <p>May:</p> <ul style="list-style-type: none"> • The Wildlife Society Board of Inquiry appointed to investigate ethics charges against two members <p>July:</p> <ul style="list-style-type: none"> • The Wildlife Society (TWS) Board of Inquiry concluded neither member violated TWS's Code of Ethics, and exonerated them of the ethics charges

Figure 1. Timeline of National Interagency Canada Lynx Survey and related events (General Accounting Office 2002, Department of the Interior and Agriculture Inspector General Reports 2002, Koenings 2002, Mills et al. 2000)

Viewpoints of Parties Involved

Media

Media-initiated distortion of information was central to the lynx controversy. Statements made by the media ran the gambit from condemning the field biologists for their actions to defending them. However the initial reports, which used language indicating fraud and conspiracy, were the most influential as they influenced the public's first impressions. Once these were formed, subsequent articles that explained the situation from the biologist's point of view and that stated there was no attempt to defraud the national lynx survey, were less compelling.

The first news story on the lynx issue, printed in the *Washington Times*, began, "Federal and state wildlife biologists planted false evidence of a rare cat species in two national forests. . . .Had the deception not been discovered, the government likely would have banned many forms of recreation and use of natural resources in the Gifford Pinchot National Forest and Wenatchee National Forest in Washington state" (Hudson 2001). The article stated that the biologists, "were testing the lab's ability to identify the cat species through DNA analysis," but went on to quote several people who were skeptical that it was an attempt to test the laboratory. The article referenced to ecoterrorist actions in 1998 by the Earth Liberation Front, after the Vail Ski Resort in Colorado announced it was going to expand trails into possible lynx habitat. These references linked ecoterrorism and the national lynx survey in the minds of the public when, in fact, the two were not related.

Media stories also played to the existing fears of segments of the public and some members of Congress that the scientific data used to manage federal lands and protect species under the ESA were unreliable. James Hansen (R-UT), chairman of the U.S. House of Representatives Resources Committee, was quoted in the *Christian Science Monitor* as saying, "The discovery of this problem underscores a long-standing concern I've had over these Endangered Species Act studies. To me, this revelation calls into question all studies that have been done over the past eight years" (Wilkinson 2002). Later articles raised suspicion about the conduct of a biologist obtaining hair samples for a grizzly bear study in Washington. No impropriety was found, but the media connection between the grizzly study and the lynx study implied that the lynx "biofraud" was not an isolated incident. "We've got to look at every study. How do we know the spotted owl study was valid?" questioned one article (Mills 2002b).

Media reporting of erroneous information also perpetuated the controversy. The *Washington Times* reported that biologists, “planted . . . samples of Canadian lynx hair on rubbing posts,” and that the samples could have, “banned many forms of recreation and use of natural resources” (Hudson 2001). In fact, the biologists did not plant the samples; they submitted them directly to the laboratory, and the samples alone would not have prevented recreational use and logging in the forest, as the national lynx survey was only one piece of the process of determining lynx presence.

Field Biologists

The biologists involved in collecting hair samples believed they were justified in submitting the unauthorized samples, as they were not trying to defraud the study, but rather to ensure that the laboratory results were accurate. Excerpts from the U.S. Forest Service’s investigative report show that, “the decision to send in the blind samples came out of a desire to know if the laboratory was able to correctly identify the lynx hair” (Lynch 2001). The biologists, “had concerns about the laboratory’s accuracy because [some] samples from the 1999 survey season had been identified as coming from domestic cats.” In addition, the results of the 1998 survey conducted by Weaver showed more lynx identified than the results from the 1999 National Lynx Survey—a difference that caused controversy within the Forest Service, “because it was unclear which results were correct” (Lynch 2001). The biologists asserted, “introducing a blind control seemed like a simple way to alleviate concerns about samples being contaminated” (Lynch 2001).

The biologists who submitted the control samples also said they were unclear on the laboratory’s protocol. According to one of the biologists, they, “had not heard anything about the quality control used by the laboratory at the University of Montana that was analyzing the samples,” nor had they, “heard anything about the . . . lab’s protocol on . . . quality assurance” (Lynch 2001). The laboratory’s DNA analysis protocol was submitted for publication in a peer-reviewed journal in 2000 and subsequently published in 2001 (Mills et al. 2000). The field personnel eventually understood that the laboratory protocol did not allow for the submission of hair samples collected outside the survey. However, the protocol did not expressly *prohibit* the submission of control samples, and, in fact, the director of the University of Montana laboratory stated, “that if someone wished to submit a control sample to the laboratory for analysis he would have

accepted it, so long as it was labeled a control sample” (General Accounting Office 2002).

In September 2000, a U.S. Forest Service biologist who participated in the survey did notify the field coordinator for the national survey that a control sample had been submitted to the laboratory as part of the survey for the Gifford Pinchot National Forest. However, the principal investigator at the University of Montana laboratory was not notified. Thus, miscommunication perpetuated the problem, since the field coordinator was not the appropriate authority to contact, and the biologist did not make clear which sample was the control. As a result, none of the hair samples submitted as part of the 2000 Survey for Region 6 (which included the Gifford Pinchot and Wenatchee national forests) were processed until the U.S. Forest Service identified the unauthorized submission.

Communication also broke down during a training session for the field personnel prior to the 2000 survey season—a session held to familiarize them with the procedures set forth in the laboratory protocol. Questions were raised to the field coordinator about the validity of the national survey protocol (General Accounting Office 2002). The field personnel were uninformed concerning DNA analysis and were confused. The U.S. Forest Service instructors were unable to answer their questions and were unable to satisfy the biologists’ concerns regarding the laboratory’s ability to accurately identify species by DNA analysis (U.S. Department of Agriculture 2002).

Despite the breakdown in communications, in the end, the biologists understood that their actions were outside the survey protocol. However, they maintained that their intention was to ensure the accuracy and integrity of the results of the survey, so future management decisions based on those results would be indisputable.

Research Scientists

The researchers involved in the lynx study were the principal investigators (PIs) working for the U.S. Forest Service and the University of Montana who developed the laboratory protocol to identify lynx using DNA analysis of hair samples, and they tested the DNA at the laboratory. The researchers say their protocol was fully diagnostic and valid. Blind tests were done internally by the University of Montana laboratory, as well as externally at the U.S. Fish and Wildlife Service laboratory in Oregon, to validate the DNA analysis procedure. In addition, other laboratory controls were used to minimize the probability of

inaccurate species identification, such as the use of positive controls to ensure test conditions were appropriate for lynx identification and negative controls to detect contamination (Mills 2002a). The protocol for the DNA analysis was peer-reviewed and published in *Conservation Genetics* (Mills et al. 2000).

Because blind samples had been used to set up the laboratory procedure, the PIs asserted that no control samples or blind samples were needed during the survey season to test the laboratory's accuracy. It was for this reason the laboratory protocol did not need, nor did it authorize, the submission of blind or control samples. The procedure for collecting and submitting samples was explained to the field personnel involved in collecting hair samples, thus the PIs maintain that any confusion due to a breakdown in communications was not the fault of researchers with the national survey. All field workers had the opportunity to ask questions and voice concerns about the protocol to the survey coordinator or the laboratory manager (Thompson and Lewis 2002).

Thus, the research scientists' concern in this controversy was two-fold. First, they were upset that the media and others questioned the validity of the laboratory protocol, implying that "the study's experimental design was deficient" (Editorial Staff 2002a, Mills 2002b). Second, they were upset that the biologists took matters into their own hands, violating the protocol to submit samples without promptly notifying the research scientists in charge and without articulating their concerns about the laboratory's accuracy to the appropriate authorities.

Despite the protocol violations by some of the field biologists, the PIs, "believe that the National Lynx Survey retains integrity to inform land management and to provide credible scientific insights on lynx distribution. Although...the few mislabeled samples have created a problem for the perception of the project as a whole, two important components...provide a firewall that protects the integrity of the study" (Mills 2002a). These components were: (1) that the lead scientists had sufficient training to interpret the survey results appropriately (i.e., a lynx detection is not the same as a lynx population) and (2) DNA hair analysis in the national survey was only the first step in evaluating lynx presence. Follow-up snow tracking and trapping efforts were included in the study to distinguish lynx populations from transient individuals or mislabeled samples.

At the conclusion of the various agency investigations into this matter it was determined that the biologists had submitted unauthorized hair samples and that they were aware that what they did was wrong. No official disciplinary action

was taken, however. Research scientists expressed concern that this lack of sanctions imposed on the guilty parties would not discourage other field personnel from violating laboratory protocol when they are confused about the procedures or concerned about their accuracy. Research scientists believe the importance of communicating concerns to the appropriate authorities or notifying the appropriate people of actions outside protocol must be stressed to those collecting data in the field. Second-guessing of peer-reviewed protocols by fellow professionals weakens the integrity of scientific research, and gives the public cause to doubt the credibility of state and federal natural resource agencies as science-based organizations.

State and Federal Natural Resource Agencies

The initial reaction of the agencies involved—the WDFW, the U.S. Forest Service and the U.S. Fish and Wildlife Service—was to denounce the biologists involved in submitting the unauthorized samples, professing outrage and embarrassment at this unprofessional and unacceptable conduct that tainted the credibility of the lynx study (Koenings 2001, Allen 2001). However, the agencies stressed that the incident did not influence any land management recommendations and that, on the whole, the agencies have, “established and maintained a reputation for highly professional and credible work,” that will ensure, “that this situation remains an isolated example of poor judgment” (Bosworth 2001). Steve Williams, Director of the U.S. Fish and Wildlife Service, testified to the U.S. House of Representatives Resources Committee that, “this is not an example of bad science by the agencies involved; instead it is bad judgment by the individuals involved” (Williams, S. 2002). A series of investigations were initiated by the agencies.

The agencies made clear they were not letting the actions of these employees go unpunished, as some media stories reported. Williams assured the U.S. House of Representatives Resources Committee that he was, “reviewing the disciplinary actions that were taken against the employees and...analyzing the Inspector General’s recommendations for further disciplinary actions.” Further, the agencies began taking steps to prevent such incidents. Chief scientists at the WDFW stated their intention to, “bring biologists together...to design and implement new procedures within the agency that will ensure WDFW’s scientific credibility is once again restored” (Pierce et al. 2001). Steve Williams promised that during his term as Director of the U.S. Fish and Wildlife

Service he would focus on, “developing personnel standards which specify disciplinary consequences for inappropriate or unacceptable behavior related to science,” revising the Service’s code of ethics, and he would focus on sound science as the foundation for decisions, particularly where ESA activities are concerned. The U.S. Forest Service reissued its code of scientific ethics, consistent with the new White House Office of Science and Technology’s policy on research misconduct (Bosworth 2002). In addition, the U.S. Forest Service and the U.S. Fish and Wildlife Service began developing new nationwide training for field biologists that stresses the importance of following approved scientific protocols and the ethical use of scientific data (Tollefson 2002).

Elected Officials

“As Americans, we should have been astounded by the recent findings that federal officials intentionally planted hair from the threatened Canadian lynx in our national forests in order to impose sweeping land management regulations. We should have been shocked at the audacity of government employees to falsify evidence in order to advance their environmental agenda, and even more perplexed at the lackluster response from their respective agencies when the transgressions were brought to light” (Pombo and Peterson 2002). These sentiments, and similar remarks implying that this kind of behavior by natural resource agencies is not uncommon, were made by numerous members of Congress—particularly members from western states—to the press and at state and federal congressional hearings. They used the lynx incident to strengthen their position that the ESA needs to be reviewed and revised.

At a congressional hearing in July 2002, the U.S. House of Representatives Resources Committee discussed legislation, entitled The Sound Science for the Endangered Species Act Planning Act (H.R. 4840). This bill would set new standards for the use of scientific information in making decisions under the ESA. Specifically, it would give greater weight to scientific data submitted by independent scientists, including commercial or industry scientists, and it would allow independent scientists, including those chosen by the governors of affected states, equal opportunity to review the data supporting or opposing an ESA decision. Several Representatives, such as Greg Walden (R-OR), James Hansen (R-UT), George Radanovich (R-CA) and James Gibbons (R-NV), testified at the hearing in support of the bill, citing the questionable actions of the state and federal agency biologists in connection with the national lynx survey as justification for

passing it. “Too often local ranchers, farmers, and state and county governments are finding themselves—and their scientific data—overruled by the U.S. Fish and Wildlife Service,” which is using “poor and phony science,” as in the case of the, “false data regarding the endangered Canadian lynx” (Congressional Press Statements 2002).

Representatives from the U.S. House of Representatives Resources Committee contacted Department of Agriculture Secretary Ann Veneman and Department of the Interior Secretary Gail Norton, saying that, “these individuals should be terminated immediately if their guilt is verifiable,” and that “the nature of these improprieties dictates an immediate and thorough review of all the data acquired during the course of the lynx survey” (House Resources Committee 2001). In addition, in response to testimony from Thomas Franklin, Wildlife Policy Director of TWS, Representative Scott McNinnis (R-CO), Chairman of the Resources Subcommittee on Forests and Forest Health, asked TWS to, “defend the credibility and integrity of the [wildlife] profession... by strictly enforcing its code of ethics and standards of professional conduct against those members of the Society implicated by this situation, [and] show zero-tolerance for this grossly unethical behavior by penalizing these individuals in a manner commensurate with the gravity of the misconduct” (Franklin 2002; Scott McNinnis, personal communication 2002).

Investigative Agencies

Several investigations were initiated to probe the facts and circumstances surrounding the submission of unauthorized samples as part of the national lynx survey. The U.S. Forest Service contracted an independent investigator at the beginning of 2001, after someone notified the agency that unauthorized lynx hair samples had been sent to the national survey’s laboratory in fall 2000. After the lynx story was reported by the media in December 2001, Congress and the Secretaries of the U.S. Departments of Agriculture and of the Interior requested further investigations from their own offices, the General Accounting Office and the Offices of the Inspector General. All of the investigations concluded that the biologists involved exhibited poor judgment and an absence of scientific rigor in lynx survey results or affect land management decisions.

Nongovernmental Organizations

The reaction from nongovernmental organizations (NGOs) fell into two groups, depending on the type of NGO. Environmental NGOs sided against the

media and politicians, who, they believe, blew the situation out of proportion by misinterpreting the events and misrepresenting the biologists involved. In response to conservative media reports that said agencies were manipulating species studies to stop activities on federal government lands, Ted Williams reported in *Audubon Magazine*, “Among the many fascinating aspects of the story is the fact that it is utterly untrue. The biologists did not plant fur in the forests. They did not conspire. They engaged in no ‘criminal’ behavior” (Williams 2002). Though environmental NGOs agreed that the biologists showed poor judgment in their actions, they asserted that the media reaction was unjustified, and they were worried about the potential backlash from Congress against the ESA. Lee Mitchell, with Public Employees for Environmental Responsibility, said that members of Congress were making this an issue to use it as, “a lightning rod to attack the ESA and the agencies and employees responsible for implementing it” (Aubrey 2002).

Private property rights groups and some recreational groups believed this lynx debacle was proof that state and federal natural resource agencies, “are out to advance an agenda that protects trees and animals at the expense of people and local economies” (Aubrey 2002). The actions of the biologists fueled the belief of these groups that agency science is biased toward an agenda that preserves open space. “There are always questions about the validity of science in any of these studies. . . .Everybody seems to back their decisions with science, but a lot of people feel a lot of these things are predetermined before they start,” said Nicholas Haris of the American Motorcyclist Association (Mapes 2001).

The Wildlife Society

TWS is an association of professional wildlife biologists and managers. The organization has a strict code of ethics for its members, and it has standards of professional conduct for certified wildlife biologists. Given this role, TWS was asked by the U.S. House of Representatives Resources Committee to testify at a congressional hearing in March 2002 on the national Canada lynx survey and endangered species data collection. Franklin represented TWS. At the time of his testimony, the identity of the individuals who submitted the unauthorized samples was unknown to TWS and the public. Thus, Franklin’s testimony described TWS, its code of ethics, standards for professional conduct, and its rigorous standards for persons engaged in wildlife surveys, management and science. He said that professional wildlife biologists might make mistakes, as any professional might,

but they learn from their mistakes and avoid repeating them. He concluded that, in the rare case that a member violates the standards of TWS, there are established disciplinary procedures to ensure that the profession's credibility is maintained and the public interest is served.

Following the hearing, TWS was asked by Congress and was challenged by some of its own members to investigate whether violations of TWS's code of ethics had occurred. One member, Jack Ward Thomas, presented a paper at the Northwest Section of The Wildlife Society Conference calling, "upon TWS to consider the acts...consider the subsequent consequences of those acts, and offer judgment as to their appropriateness. . . .If the judgment of the government investigations and resulting personnel actions were incorrect or inappropriate TWS should vigorously defend both the actions and those who carried them out. . . .If the decision is otherwise, TWS's condemnation of those actions should be clear and forceful. . . .We trust TWS will not let this matter drop and will move ahead to review the situation and take appropriate actions to clarify whether such acts can be considered appropriate actions by wildlife biologists" (Thomas and Pletscher 2002).

In response to a formal request by a member, TWS President Diana Hallett appointed a board of inquiry and charged them with determining whether or not members of TWS violated the code of ethics. There were limitations on this investigation, however. First, the board of inquiry could only review the actions of TWS members, and only two of the seven biologists involved were members. Second, the board could evaluate the members on their behavior under the member code of ethics. A challenge of violating the standards of professional conduct and code of ethics under the certification program would require a formal charge against a certified wildlife biologist. Such a charge was not forthcoming. Finally, violations of the code of ethics can result in censure (official reprimand), or censure and suspension from the TWS. TWS cannot impinge further punishment on the individuals if they are found guilty of violation, as was demanded by some elected officials.

Following thorough review and discussion of the potential ethics violations, the board of inquiry concluded that neither TWS member investigated violated the TWS code of ethics, and, therefore, they should be exonerated of the ethics charges. The board did find that the members committed errors in judgment, but their rationale for submitting the samples was consistent with the code of ethics, in that they were seeking to ensure data from the laboratory were accurate.

Furthermore, neither member acted in a manner that suggested they were trying to influence the outcome of the survey. The board believed two factors in particular supported the field biologists' assertion that they were trying to check the laboratory's accuracy, not to indicate a presence of lynx where there were none. First, one of the unauthorized samples submitted was bobcat hair, not lynx hair; second, the biologists included fictitious location codes on their samples, so they would not be mistaken as coming from actual collection sites. The board suggested that poor timing and poor communication largely were responsible for the members' actions in seeking to test the laboratory.

The conclusion of the board of inquiry did not lay the matter to rest in many people's minds, but the prescribed inquiry process was properly carried out, and, therefore, the board's determination stood. TWS's role in the issue is not finished, however. It has offered to work with the U.S. Forest Service and the U.S. Fish and Wildlife Service to develop and advance their ethics training for biologists. In addition, TWS will continue to ensure that its members uphold the code of ethics and standards for professional conduct.

Observations and Recommendations

The Case of the Missing Lynx has been an unfortunate smear on the wildlife profession, but it offers an opportunity to draw some conclusions about the realities and potential conflicts surrounding science, policy and politics of wildlife issues, to learn from the mistakes, and to strengthen the credibility of the profession in the future. As Thomas said, "Perhaps the most important action to be undertaken at this juncture is to recognize and act upon the lessons to be learned from this sad state of affairs" (2002).

The case illustrated that a few individuals and their actions can impact an entire profession. The behavior of just seven biologists did much to affect the credibility of wildlife science as a whole, and it fueled arguments by some members of Congress that the guidelines for the use of science in the ESA need to be reexamined. This serves as a reminder that every professional must uphold the integrity of wildlife biology and management, in order for the entire profession to remain credible. We cannot work without or against each other if we hope to remain strong and influential in natural resources management.

The case also highlighted the volatile nature of public and political perceptions of endangered species issues. Biologists must be aware that their

actions will come under scrutiny, particularly when the scientifically proven existence of threatened or endangered species could alter the use of public or private lands. Some members of Congress and nongovernmental organizations were quick to believe and support media reports that biologists were tainting data to accomplish their personal environmental agendas and to restrict activities on federal lands. Given the tensions concerning endangered species and limitations on public lands, this situation could have happened anywhere, to anyone working on such projects. We must ensure that our activities are transparent, both to our peers inside the profession and to stakeholders. There must be no cause for anyone to question our actions or our motives.

Poor timing and poor communication contributed to the lynx controversy. The biologists should have voiced concerns, asked questions and sought clarification for the parts of the protocol they did not understand; they should have communicated these issues to the appropriate authorities—namely, the principal investigators at the DNA laboratory. Leadership in the U.S. Forest Service should have immediately and publicly dealt with the submission of unauthorized samples, knowing the profile of endangered species issues. Media reporters should have verified their statements with the biologists and the agencies involved, instead of reporting only the comments of enraged public officials and NGOs. Open and honest channels of communication between professionals, agencies, Congress and the public are essential for our profession to remain credible and to maintain the public's trust in our science and management decisions.

Finally, the lynx issue makes a case for professional wildlife biologists and managers to become certified wildlife biologists, to seek continuing education and training, and to improve media relation skills. It demonstrates the value to public agencies of requiring their biologist employees to become certified professionals to ensure that they meet appropriate education, experience and ethical standards. The certification program defines minimum standards of education and experience for professional wildlife biologists, and it establishes a procedure for critical peer evaluation of wildlife biologists, to create and maintain public confidence in our advice and opinions. Continuing education will ensure that wildlife biologists and managers are up-to-date with the changing standards, methods, techniques and protocols of the profession. Improved media relations will foster accurate communication of natural resource agency findings, interests and priorities to the public. And, it will help to avoid lynx scandals in the future.

Achieving these goals, if aspired to by all practicing wildlife biologists and managers, would strengthen the credibility of the profession as a whole.

This case exemplifies the importance of upholding standards of professional conduct, following protocols and seeking resolution of concerns through the appropriate channels. Our work can affect not only natural resources, but also human lives and livelihoods. Therefore all our actions must be open and legitimate. Individual reputations are on the line, as well as the reputation and credibility of our entire profession. Maintaining and adhering to a strong code of ethics and standards of professional conduct are integral to avoiding problems and protecting credibility, no matter if you are a field biologist, a researcher, a professor or an administrator.

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Session Four.
***Trouble in the City: Human and Wildlife Conflicts
in Urban and Suburban North America***

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Tremors along the Urban-Wildlife Fault Line

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Wildlife in North America witnessed a cataclysmic event, so profound it changed the course of human history, how they viewed their place in the world and their sense of beauty. We are not speaking of a great flood or an earthquake, or even the American Revolution. Rather it was an event that happened in the late 1800s, the closing of the frontier (Conover 2001, Hine 2003). Many fail to realize the significance of this event today for two reasons: (1) the changes it wrought were gradual in their manifestation, and (2) we fail to recognize how many of our views of wildlife have changed from those of our forebearers who living before the closing of the frontier.

Since the English first arrived on this continent during the 1500s, many viewed North America not as a paradise but a hostile and desolate wilderness (Marcus and Burner 1995). They saw it as a continent with a single, redeeming

quality—its malleability. Through hard work and the help of God, they believed that it could be transformed into a land of plowed fields, pastures, fences, orchards, homes and towns, a place that resembled the Europe they had left (Cronin 1983). They feared that such a transformation would not be easy, given the obstacles of dangerous predators, wild beasts, fierce Native Americans, storms, famines, floods and maybe even Satan (Geller 1974). But, they believed in themselves, and those who lived long enough were able to look back with satisfaction at how much progress in conquering the wilderness had been made during their lifetimes. And, conquer it they did. In succeeding generations, the frontier was pushed back from the Atlantic Ocean, to the Piedmont, to the Alleghenies, to the Ohio Country, to the Plains, and to the Far West. Finally, during the late 1870s, the remote parts of the Intermountain West were settled. The task undertaken by European settlers on the shores of the Atlantic Ocean 300 years earlier was finally completed in the Rocky Mountains (Goldfield et al. 2001, Ayers et al. 2003).

Yet, rather than causing a national celebration or a sense of accomplishment, the closing of the frontier caused North America to enter a period of introspection as the country pondered what had been accomplished and what had been lost (Nash 1989, Wilkins 1995). The adage, “be careful what you wish for, it may come true,” certainly applied to this situation. Subsequent to the closing of the frontier came the Industrial Revolution with all of its attendant problems: long working hours, dangerous working conditions, pollution, squalor and poverty (Hall et al. 2003). Americans began to question the value of human progress. Their sense of beauty slowly shifted from the works of humans and industry to the works of nature. Paintings of wildlife and wilderness landscapes replaced those of trains, buildings and cities. Pockets of pristine land in the United States were set aside for national parks. For the first time, laws were passed and enforced that protected wildlife from being over-harvested by humans over vast landscapes, such as entire states or the entire country (Faragher et al. 1997).

Spurred by the belated realization of wildlife’s value, the science of wildlife management came into existence. We began to preserve critical habitat for endangered and threatened species and to improve the habitat for others. Wildlife species, which had nearly been extirpated, were successfully reintroduced into their former habitat. In response to all of these changes, wildlife populations that had been suppressed by human activities began to make a dramatic comeback (Conover 2001).

These increasing wildlife populations were, for the most part, “out there,” or along the remnants of the old frontier or in rural areas. Out there was an appropriate phrase, for North Americans no sooner conquered the wilderness than they abandoned it for urban centers and the jobs created by the Industrial Revolution. This migration of people from rural to urban centers was profound. During the American Revolution, 90 percent of the population were farmers, and the largest cities (i.e., Boston, New York, Philadelphia and Charleston) contained between 10,000 and 30,000 people (Henretta et al. 2000). By 2000, 2 percent of the population were farmers, and 80 percent of U.S. residents lived in metropolitan areas (U.S. Census Bureau 2001).

Because of this human migration from rural to urban areas, most North Americans living in the latter half of the 20th century became physically separated from wildlife. Vacations in remote areas and outdoor activities, such as camping trips, hiking, fishing and bird watching, became popular distractions in an urbanized society. Not surprisingly, wildlife were managed mainly to provide recreation for both urban and rural citizenry. Because of the adoption of the new mass media of radio and television, people did not have to leave urban areas to learn about or follow the fate of wildlife living hundreds of miles away from them (Conover 2001).

How will future historians look back upon the 20th century? We think they will view it as the golden age of wildlife management. It will be viewed as an era when the easy steps to increase wildlife populations were taken, and wildlife management was not very controversial. Compared to their own times, they will marvel at the concept of managing wildlife for consumptive use. They will note that during the 20th century wildlife was out there, out in some remote mountain valley or primordial swamp, but this will change by then. Wildlife will not be out there; rather, it will be here, meaning where people live—in metropolitan areas. Wildlife will be in their garbage cans and in their attics. Wildlife will be in their gardens, feeding at the exact spot where only yesterday stood rows of ripe corn.

We predict a vast shift in wildlife populations into metropolitan areas. They will follow the crowds of people, who have already made this journey, seeking the new habitat and open niches that humans have created in metropolitan areas. This movement of wildlife into metropolitan areas will result from the adaptability of wildlife. They will learn how to live in human-dominated environments, regardless of whether humans want them there or not. It is this

learning process that will have the greatest impact on wildlife populations in the 21st century.

What will urban migration mean to wildlife populations? Perhaps it is instructive to look at Canada geese (*Branta canadensis*) because they have been one of the first wildlife species to learn to adapt to the urban environment. During the 1970s, several states wanted to establish breeding populations of nonmigratory Canada geese. Using geese caught from urban flocks from the Midwest, these efforts were largely successful. The only problem was that the geese did not stay in the rural areas where they were released by the wildlife biologists; instead, they immediately flew to nearby urban areas looking for golf courses and other familiar habitat.

At the time, we were living in Connecticut and started studying New Haven's newly created goose population. We found that these geese enjoyed a low mortality rate because there were few hunters or predators in urban environments, plenty of food and excellent nesting habitat. This urban goose population was distinctive from migratory goose populations which bred in the Arctic and wintered further south. Even when in Connecticut, the migratory geese remained separate from the urban geese. The latter spent their days in urban areas, foraging on golf courses and parks while the migratory geese were in rural areas where they found pastures, harvested corn fields, alfalfa fields and hunters. By the 1990s, urban goose populations in the Atlantic Flyway had so increased that they outnumbered migratory geese. This was an amazing feat, considering that an urban goose was nonexistent a mere 30 years earlier.

These urban geese populations also began to impact the behavior of the migratory subspecies of Canada geese. In New England, hunters soon noticed that migratory geese began to spend more and more time in the state during the fall and spring rather than heading further south. It is impossible to prove that this short-stopping of migratory geese in New England had anything to do with the creation of urban goose populations, but the timing of the event certainly is suspicious. In the last few years, there has been an increasing number of migratory Canada geese foraging on golf courses. Perhaps, the distinction between the two populations of geese, one migratory and breeding in the Arctic and one nonmigratory and breeding in urban areas, is unstable, and these two populations will blend into one amorphous population. Today, for example, there is no distinction between an urban raccoon and a rural raccoon.

When Canada geese first settled an area, they were universally welcomed by the citizens of the state. But, as urban goose numbers increased,

problems emerged, and people became upset. Local hunters were not happy that the geese rarely ventured into rural areas where they could be hunted. Wildlife biologists were dismayed that the urban goose numbers were soon growing out of control and that wildlife agencies no longer had the ability to limit their populations. Metropolitan residents were beginning to realize that Canada geese start their day before sunrise, even on holidays and during the summer when dawn occurs before 6:00 a.m. People also found that with geese come feces; golf courses, backyards, beaches and playing fields were soon littered with the foul offal. Many people began to lose tolerance for the birds; arguments ensued with neighbors who still enjoyed the geese and wanted more geese, not fewer. Decisions on how to manage the geese became controversial, and the state wildlife agencies were often caught in the middle.

What is the lesson that we can learn from urban Canada geese? The expansion of wildlife populations in urban areas is initially welcomed by metropolitan citizens, but, as wildlife populations increase, human-wildlife conflicts increase, and some people begin to lose their tolerance for the same animals they earlier adored. By this time, the ability of wildlife agencies to manage the urban wildlife population will be limited, and any decisions the agency makes will be controversial. Yet, with conflict comes opportunity.

Many wildlife agencies currently view their primary responsibility as one of maintaining the maximum sustainable yield of game species for hunters and fur trappers and maximizing populations of charismatic megafauna. They are reluctant to devote significant resources to the resolution of human-wildlife conflicts in urban areas. Yet, the popularity of hunting and fur trapping has declined in the United States for many years; only 6 percent of the U.S. adults participated in hunting during 2001 (U.S. Fish and Wildlife Service 2002), and even fewer engaged in trapping. With such low levels of participation, one questions how wildlife agencies can maintain their relevance to society in the future. Is there a needed service which they can provide? The answer lies in the growth of urban wildlife populations and the increasing human-wildlife conflicts.

Most urban residents confronted with a wildlife damage problem are unable to solve it themselves and seek help (Conover 1997). Government exists to help people solve problems they cannot solve individually. Wildlife agencies have the mandate and are uniquely equipped to help our urban citizens deal with these exasperating problems. In doing so, wildlife agencies will ensure their

own future and change urban wildlife management from a minor subdiscipline to the front line of wildlife management. More importantly, by helping resolve human-wildlife conflicts, wildlife agencies will help to insure that the future of wildlife will always rest securely on the continent of North America and in the hearts of its citizens.

All these changes of which we have spoken—the shifting populations of people and wildlife into metropolitan areas, changing human attitudes and diminished tolerances—are the aftershocks that reverberated from the closing of the frontier over a century ago. They have occurred along one of that cataclysmic event's most active fault lines: the one running along the urban-wildlife interface. Of this we can be assured, future tremors will occur along this same fault line.

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Public Values and Urban Wildlife: A Love-Hate Relationship or Too Much of a Good Thing?

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During the closing decades of the 20th century, the populations of deer (*Odocoileus* spp.), elk (*Cervus elaphus*), black bear (*Ursus americanus*), cougar (*Puma concolor*), coyote (*Canis latrans*), beaver (*Castor canadensis*), prairie dogs (*Cynomys* spp.), Canada geese (*Branta canadensis*) and other wildlife species increased in urban and suburban environments in North America. At least three factors contribute to the population growth in urban and suburban areas. First, as a result of effective wildlife conservation and management, the populations of many species have recovered from historic lows experienced in the early 20th century (Mitchell et al. 1997, Warren 1997, Organ and Ellingwood 2000). Second, in many areas, human residential development is encroaching into prime wildlife habitat (Decker and O'Pezio 1989, Halfpenny et al. 1991, Peck and Stahl 1997, Peine 2001). Third, adaptability and habituation leads animals to exploit abundant feeding opportunities in human residential areas (McCarthy and Seavoy 1994, McCullough et al. 1997, Peck and Stahl 1997, Whittaker and Knight 1998).

Many residents of urban and suburban areas enjoy seeing wildlife (Green et al. 1997, Zinn and Andelt 1999, Miller et al. 2000, Coluccy et al. 2001, Chase et al. 2002) and spend time and money to attract wildlife to their yards (Fort Collins Natural Resources Division 1992, Miller et al. 2000, Miller et al. 2002). Whether or not it is deliberately selected for its wildlife value, ornamental vegetation planted by humans is often attractive to wildlife (Stout et al. 1997, Organ and Ellingwood 2000). Because human enjoyment of wildlife in urban and suburban settings is widely recognized, wildlife potential is a feature used to promote real estate developments, as well as the sale of individual parcels (Harris et al. 1997, Rudzitis 1999).

Although wildlife is widely enjoyed in urban and suburban areas, enjoyment comes at a cost. For example, ornamental and native vegetation are damaged by elk (Chase and Decker 1998), deer (Butfiloski et al. 1997, Kirkpatrick et al. 1997, Mitchell et al. 1997), prairie dogs (O’Meilia et al. 1982, Fort Collins Natural Resources Division 1992) and beaver (Harbrecht 1991). Property loss and human injury are caused by deer-vehicle collisions (Butfiloski et al. 1997, Curtis and Hauber 1997). Disease transmission to humans and pets may involve deer (Seimer et al. 1992) and prairie dogs (Barnes 1993). Low-lying areas are flooded by beaver (Harbrecht 1991). Private yards, parks, playing fields and golf courses are damaged, and water supplies are contaminated by geese (Coluccy et al. 2001). Humans and pets are sometimes injured or killed in attacks by cougar (Beier 1991), black bear (Peine 2002) and coyote (McCullough et al. 1997). Responding to wildlife problems is a growing burden for state agencies. Nuisance animal removal permits issued by the Illinois Department of Natural Resources increased almost five-fold between 1985 and 1995 (Bluett 1999). Increasingly agencies are under pressure to respond to constituent complaints, yet they manage nuisance wildlife with methods acceptable to diverse stakeholders.

Helping stakeholders attain (and maintain) urban and suburban wildlife population levels that maximize benefits while minimizing costs has become one of the most difficult challenges facing wildlife management professionals today. For example, the Georgia Department of Natural Resources first responded in 1988 to concerns about white-tailed deer overabundance in one private residential development, yet implementation of deer control measures began only in 1994, after two legal challenges and the formation of two different stakeholder committees (Butfiloski et al. 1997). Moreover, wildlife managers are constrained by costs associated with managing nuisance urban wildlife. Between 1992 and 2000, private nuisance wildlife control officers licensed by the Illinois Department of Natural Resources responded to more than 495,000 wildlife conflicts and handled more than 483,000 animals, relocating more than 166,000 of these animals (Bluett et al. 2003). Agencies face both overwhelming costs associated with problem wildlife and disagreement over appropriate wildlife population levels and appropriate wildlife management actions. Stakeholders often differ, not only about how many animals should exist, but also about how animals should be treated, particularly when lethal control measures are being considered (Wittmann et al. 1998). Thus, the process of identifying and achieving desirable population levels for wildlife in urban and suburban settings has sometimes

triggered public protests and disruption of management actions (Kirkpatrick et al. 1997), inaccurate and inflammatory media reports (Green et al. 1997, Peck and Stahl 1997), and, in at least one case, the necessity of special enabling legislation (DiNicola et al. 1997).

The contentiousness that so often surrounds management of wildlife populations in urban and suburban areas is rooted in the widely divergent perceptions and preferences that stakeholders bring to the table. To better understand the divergent perceptions and preferences expressed by people from communities across North America, we have undertaken a review of thresholds of tolerance for wildlife populations, acceptability of management actions toward wildlife and a framework for understanding these human responses to wildlife.

Thresholds of Tolerance for Wildlife Populations

In their discussion of thresholds of tolerance for wildlife populations, Wagner and Seal (1992) focused on situations where traditional, desirable species have become so numerous that some stakeholders want to see population growth stopped or even reversed. They termed this situation overabundance, a condition in which positive values accorded to a particular species are outweighed by negative values. A key aspect of this work was recognition that definitions of overabundance change as human values change. Thus, thresholds of tolerance are determined by subjective human perceptions, as well as by objective numbers. Accordingly, when the importance stakeholders place on positive and negative values changes, thresholds of tolerance also will change.

This description was consistent with research demonstrating that thresholds of tolerance for white-tailed deer can vary with human land-use practices and behavior, even when biological carrying capacity remains constant (Ellingwood and Spignesi 1986). Although rural and urban study areas contained similar deer habitat and deer densities, human tolerance for deer in the urban area was eventually exceeded as the number of deer-vehicle collisions increased three-fold during a ten-year period. Extending this work, Minnis and Peyton (1995) demonstrated that thresholds of tolerance for wildlife populations vary with occupation or social role, as well as subjective personal beliefs about wildlife population trends. Compared to hunters, farmers were willing to tolerate fewer white-tailed deer, regardless of deer density. Similarly, individuals who believed the white-tailed deer population was increasing tended to say there were too

many deer, whereas individuals who believed the white-tailed deer population was decreasing tended to say there were too few deer. Thus, in one geographic area, thresholds of tolerance were shown to vary from person to person and to be determined by subjective perceptions of deer populations, rather than actual population levels.

Similarly, perceptions of wildlife populations can be affected by personal experiences with wildlife damage. In a study of Chicago area homeowners, Miller et al. (2000) found that, compared to homeowners who had not experienced nuisance wildlife problems, those who had experienced wildlife damage perceived higher populations of the species responsible for damages. Furthermore, homeowners who experienced damage perceived populations of the species responsible for damages to be increasing but perceived no similar increases among nonproblem species near their homes.

Thresholds of tolerance are sometimes related to concern about risks posed by wildlife populations. In one study, for example, tolerance for white-tailed deer was predicted by the perceived risk of deer-related vehicle accidents (Stout et al. 1993). A majority of respondents had personally experienced or narrowly missed experiencing a deer-related accident, yet most estimated that they were unlikely to be involved in a deer-related accident in the future, perhaps because vehicular accidents, although serious, are relatively common and well understood. In contrast to deer-vehicle accidents, some risks posed by wildlife are serious, but they are remote and poorly understood, like the risk of being attacked by a cougar. When risks are remote and poorly understood, humans sometimes overestimate the probability that they may be personally involved (Slovic 1987, Riley and Decker 2000). In this type of situation, people who are most familiar with a remote, poorly understood risk are less likely to overestimate the probability of being involved. This is consistent with findings that residents of suburban fringe areas, where cougars are comparatively common, expressed less fear of being attacked than residents of urban core areas, where cougars are comparatively rare (Manfredo et al. 1998). These studies of perceived population trends and perceived risk demonstrate importance of subjective perceptions in understanding human responses to wildlife.

Acceptability of Management Actions toward Wildlife

Findings about stakeholders' thresholds of tolerance for different wildlife population levels are paralleled by findings about the acceptability wildlife

management actions toward wildlife involved in human-wildlife interactions. In one New York example, people living in areas with higher deer densities were more likely than those in other areas to accept lethal actions to reduce the deer population (Lauber and Knuth 2000). Similarly, residents of central Missouri who had experienced Canada geese using their property were more likely to accept a wide range of aggressive, lethal and nonlethal goose-control actions (Coluccy et al. 2001). A comparison across three different wildlife species and three different communities in New York indicated that, as concern about human interaction with white-tailed deer, beaver or Canada geese increased, acceptance of invasive management actions (i.e., capture and relocation, killing by hunting or trapping) also increased (Loker et al. 1999).

Using a framework from social psychology, human judgments about wildlife populations and the acceptability of management actions toward wildlife can be conceptualized as normative beliefs. This approach was used to measure the acceptability of management actions toward cougar, coyote and beaver involved in human-wildlife interactions in urban and suburban areas of Colorado (Zinn et al. 1998). Results illustrated that normative beliefs about the acceptability of wildlife management actions are influenced by situational specifics and wildlife value orientations. For example, the acceptability of different management actions toward a cougar found in a residential area depend on situational differences. Monitoring a cougar was widely acceptable if the animal had harmed nothing. If, however, the cougar had attacked a pet or a human, monitoring was less acceptable. In contrast, destroying the cougar was widely acceptable only if it had attacked and killed a human being. Unlike monitoring or destroying the cougar, capture and relocation was acceptable to a majority, regardless of situation. In addition to being influenced by situational differences, beliefs about management actions were also influenced by wildlife value orientations. Across all three species (cougar, coyote and beaver), individuals with protectionist wildlife value orientations were less willing to destroy an animal than were those with utilitarian wildlife value orientations.

A Framework for Understanding Human Responses to Wildlife

At least two important themes emerge from these studies. First, thresholds of tolerance for wildlife populations, as well as the acceptability of wildlife management actions, are based on a complex set of multiple

determinants, including characteristics of the wildlife species in question, situational specifics, past experiences and psychological variables, such as beliefs and attitudes. Second, among the many determinants, subjective factors, such as values and beliefs, will be at least as important as objective factors, such as species, actual populations and situational specifics.

A normative framework based on social psychology's hierarchical model of the human mind can account for subjective, psychological determinants of human responses to wildlife, such as values and beliefs, as well as objective determinants, such as species, actual populations, and situational specifics (Zinn et al. 2000). In the hierarchical model of human thought (Figure 1), values are defined as a small number of broad, fundamental beliefs used to evaluate behavior, e.g., honesty, equality, life conditions, freedom or oneness with nature (Rokeach 1979, Homer and Kahle 1988, Schwartz 1992, Schwartz 1996). Broad, fundamental values influence specific thoughts and behaviors indirectly through more numerous basic beliefs about specific objects or issues (Fulton et al. 1996). The patterns of direction and intensity among basic beliefs about a single object or issue are called value orientations. Along with personal experience and situational conditions, value orientations influence many specific beliefs such as attitudes and norms. In turn, the many specific attitudes and norms, including normative beliefs about wildlife, influence behavioral intentions, which then influence behavior directly (Figure 1).

Evidence demonstrates this hierarchical relationship among wildlife value orientations, specific attitudes, and participation in hunting and fishing (Fulton et al. 1996). Broad utilitarian or protectionist value orientations directly influence specific attitudes toward hunting and fishing, and, in turn, specific attitudes toward the activities influence behavioral intentions to hunt and fish. As suggested above, the value-attitude hierarchy is not the only influence on behavior. Participation in hunting and fishing also will be influenced by behavioral variables like childhood experience with wildlife and occupation, as well as situational specifics like game abundance and monetary or nonmonetary opportunity costs.

Evidence of the Determinants of Human Responses to Wildlife

Research provides evidence that all three types of variables—psychological, behavioral and situational—influence human responses to wildlife. The influence of value orientations on the acceptability of management actions

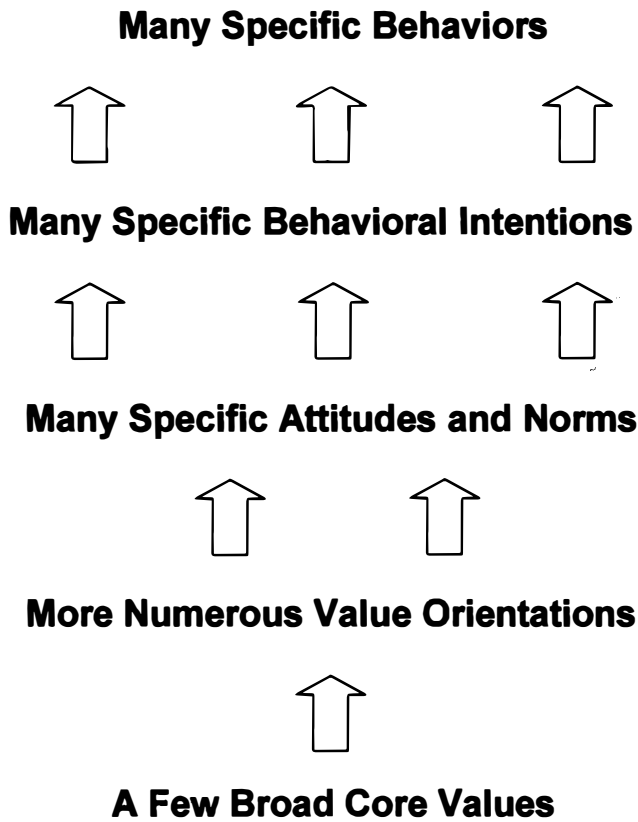


Figure 1. Cognitive hierarchy of psychological variables

was demonstrated in a Colorado study of responses to cougars and cougar management in residential areas (Zinn et al. 1996). Increased cougar hunting as a population control measure was accepted by fewer than 25 percent of respondents who expressed protectionist wildlife value orientations, but more than 60 percent of those who expressed utilitarian value orientations (Figure 2A). Similarly, destroying a cougar that had attacked and injured a human was accepted by fewer than 40 percent of those who expressed protectionist value orientations, but more than 70 percent of those who expressed utilitarian orientations (Figure 2B). Value orientations also predicted acceptance of lethal control among homeowners who had experienced raccoon (*Procyon lotor*) damage in the Chicago metropolitan region. Compared to those with positive wildlife rights orientations, those with negative wildlife rights orientations were more than twice as likely to prefer lethal control (Miller 2002).

A. Acceptability of increased cougar hunting

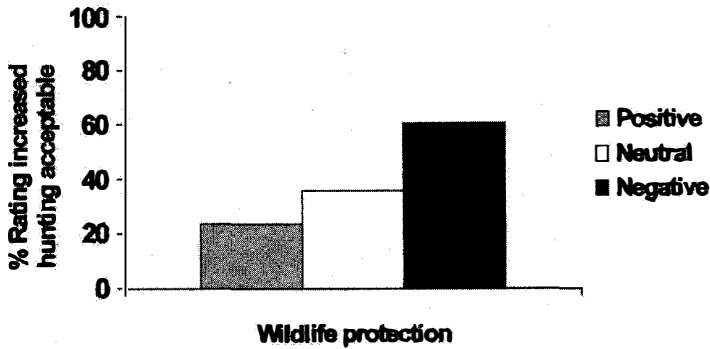
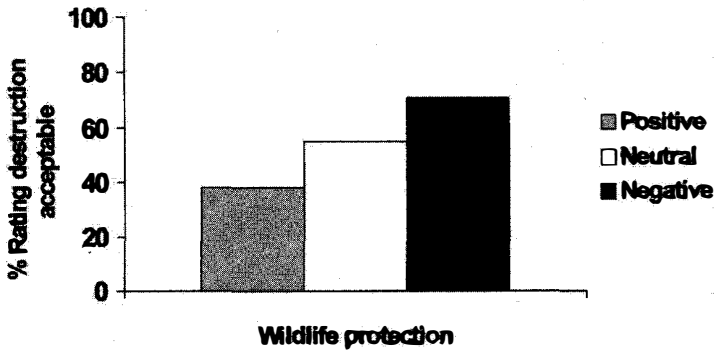


Figure 2. Wildlife value orientation and acceptability of management actions toward cougars (from Zinn et al. 1996)

B. Acceptability of destroying cougar that has injured a person



Like wildlife value orientations, personal experience has been shown to influence acceptance of wildlife management actions. Among residents of La Plata County, Colorado, occupational experience influenced the acceptability of protecting wildlife habitat (Layden et al. 2003). Fewer than one third of respondents employed in the agricultural sector of the economy accepted protecting additional wildlife habitat, whereas one half of those employed outside the agricultural sector accepted the same action (Figure 3A). This difference in the perceptions of stakeholders working inside and outside the agricultural sector of the economy parallels findings about thresholds of tolerance for white-tailed deer in Virginia (West and Parkhurst 2002).

A. Occupational sector & acceptability of protecting wildlife habitat

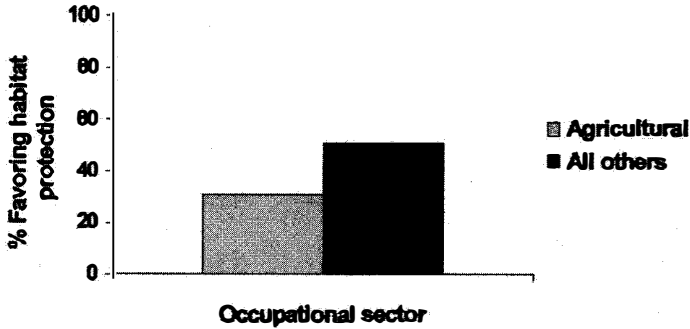
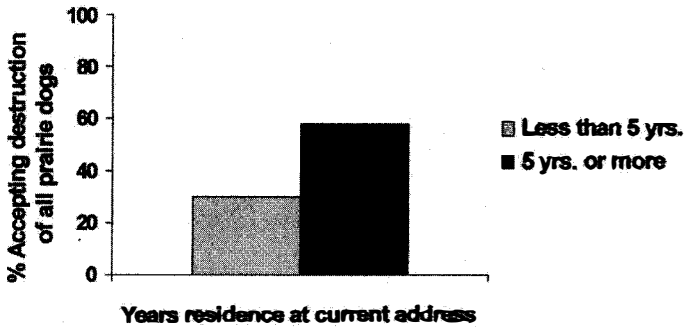


Figure 3. Behavioral variables and acceptability of management actions toward wildlife (panel A from Layden et al. 2003; panel B from Zinn and Andelt 1999)

B. Residential experience & acceptability of destroying all prairie dogs



In Fort Collins, Colorado, among residents living near colonies of black-tailed prairie dogs, thresholds of tolerance for prairie dog populations were influenced by past residential experience (Zinn and Andelt 1999). Nearly 60 percent of respondents who had lived near colonies five years or longer were willing to accept destroying all prairie dogs in the community, whereas only 30 percent of respondents who had lived near colonies less than five years were willing to accept the same management action (Figure 3B). Similar differences based on residential experience have been found for white-tailed deer, beaver and Canada geese (Loker et al. 1999, Coluccy et al. 2001).

A comparison of normative beliefs about lethal control of beavers and coyotes demonstrates that situational variables, such as where an animal is found, what species is involved and the nature of risks posed, also influence the acceptability of management actions (Zinn et al. 1998). In situations where a beaver or a coyote was seen in public, open space, in a residential area, or in one's own yard, respondents were generally unwilling to accept destroying an animal; although, opposition to destroying the animal diminished modestly for a sighting in the respondent's own yard (Figure 4). In addition, respondents were generally less opposed to the destruction of a beaver than a coyote, regardless of where the animal had been seen. Lethal control was widely accepted, however, for a beaver or a coyote carrying a disease harmful to humans. The sharp difference in acceptability indicates that wildlife managers considering the use of lethal control could anticipate minimal controversy in a situation where stakeholders were aware that the animal carried a disease harmful to humans.

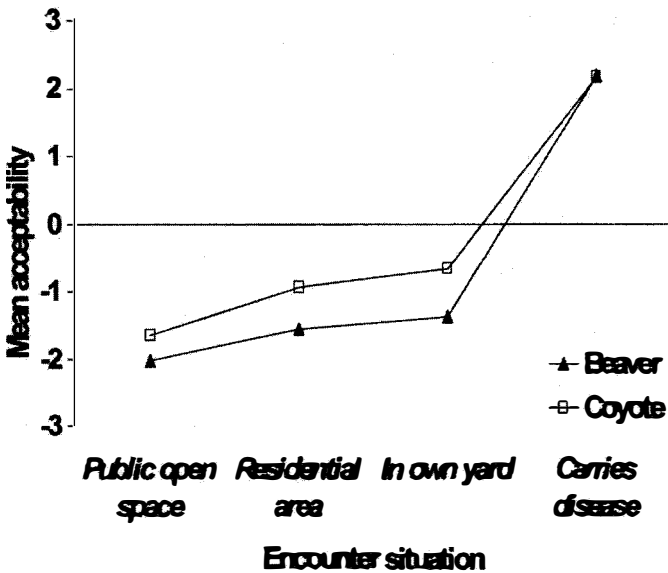


Figure 4. Wildlife species, encounter situation and acceptability of destroying an animal (from Zinn et al. 1998).

The Importance of Multiple Effects

When examined singly, internal, psychological variables (e.g., value orientations), behavioral variables (e.g., occupation) and situational specifics (e.g., species or management action) all influence stakeholders' responses to wildlife. However, these variables rarely operate in isolation, so it is important to

consider multiple effects. The complex foundations of responses to wildlife can be seen by examining the combined influence of situational specifics, wildlife value orientations and gender on the acceptance of destroying a cougar found in a residential area (Zinn and Pierce 2002). In this study, the acceptability of destroying a cougar in a residential area was measured across four different encounter situations. These included a cougar sighting, a cougar killing a pet, a cougar injuring a human and a cougar killing a human.

As the encounter situations changed in severity, the acceptability of destroying a cougar varied greatly (Zinn and Pierce 2002). Destroying an animal that had been sighted or had killed a pet was widely opposed (Figure 5). In contrast, opinion was divided regarding an animal that had injured a human, and destroying an animal that had killed a human was widely acceptable. Although mean acceptability ratings for destroying a cougar increased as encounter situations became more severe, responses also were influenced by both wildlife value orientation and gender. Across the four situations, respondents with utilitarian wildlife value orientations were consistently more likely than those with protectionist value orientations to accept destroying a cougar. In the human injury and human death situations, males were more likely than females to accept destroying a cougar. This difference between genders is consistent with differences found in at least two general population surveys of responses to wildlife (Mankin et al. 1999, Czech et al. 2001).

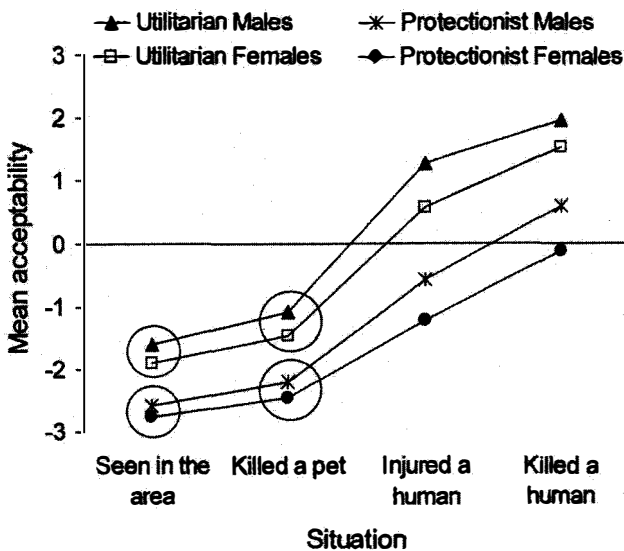


Figure 5. The acceptability of destroying a cougar found in a residential area: Influence of situation, wildlife value orientation and gender. Circled means did not differ at $p < 0.05$ in Tukey post hoc comparisons conducted for each situation (from Zinn and Pierce 2002).

Especially noteworthy is the situation where a cougar had injured a human. In this situation, those with utilitarian value orientations (51% of sample) and those with protectionist value orientations (49% of sample) were divided over the acceptability of destroying a cougar. On average, utilitarians found destroying the cougar acceptable, but protectionists found destroying the cougar unacceptable. Findings like these help wildlife managers anticipate situations where public opinion is likely to be divided and conflict over a particular management action is likely to be intense.

In another example of the importance of multiple effects, value orientations, situational specifics and receipt of information about controlling nuisance wildlife contributed to acceptance for lethal control of raccoons, coyotes, Canada geese and white-tailed deer in Illinois (Miller et al. 2000, Miller et al. 2002). Support for lethal control was predicted by personal experience with nuisance wildlife problems and negative orientations toward wildlife rights. In contrast, receiving information on nonlethal methods to prevent wildlife damage increased opposition to lethal control. Taken together, receiving information on steps to prevent wildlife problems was a stronger predictor of attitudes toward lethal control than value orientations or past experience of problems.

Conclusions

Responses to wildlife are influenced by multiple determinants and vary broadly for individuals and for stakeholders. For example, value orientations, perceptions of risks and situational differences influence stakeholders' judgments about optimum wildlife population levels and the acceptability of wildlife management actions. Because responses to wildlife are products of complex determinants, simplistic approaches to measuring and understanding them are likely to be inadequate. Responses to a single, broad question (e.g., What size deer population is acceptable in the area?) leave too much unknown about stakeholders' thresholds of tolerance for deer, and they can be misleading because normative beliefs depend greatly on individual perceptions, past experience and situational specifics.

From a social-psychological perspective, the determinants of responses to wildlife and management actions fall into three classes: (a) internal, psychological variables, such as value orientations and more specific beliefs; (b) behavioral variables, such as occupation and past experience with wildlife; and

(c) situational specifics, such as wildlife species, encounter frequency and management actions. Among these variables, subjective factors, such as value orientations and perceptions of population levels, benefits and risks, appear to be at least as important as objectively-measured populations, benefits and risks. By accounting for the influence of subjective and objective variables in a well-tested, theoretical model of human thought, a normative approach maximizes our ability to understand and predict both the determinants and consequences of stakeholder responses to wildlife and management actions across species, situations and stakeholder groups.

Future Research Needs

In this review, we considered relationships between responses to wildlife and a limited set of predictive variables, including wildlife species, utilitarian and protectionist wildlife value orientations, gender, occupational and residential experience, and several situational specifics. To generalize with confidence about the influence of these variables on responses to wildlife and management actions, additional research will be needed on a broad range of species, settings and conditions. For example, this paper focused on a utilitarian and protectionist orientation identified by Fulton et al. (1996) and a wildlife rights orientation examined by Miller (2002). Additional research will be needed to examine the impact of other domains (e.g., educational and recreational value of wildlife), identify additional relevant domains, and demonstrate predictive relationships between wildlife value orientations and behavior. Similarly, the influence of gender will require additional investigation. Some evidence suggests that females are more likely than males to express protectionist value orientations (Mankin et al. 1999, Czech et al. 2001, Vaske et al. 2001, Zinn and Pierce 2002), but other studies of broader environmental value orientations have found no gender differences (e.g., Lyons and Breakwell 1994, Scott and Willits 1994).

Understanding stakeholders' thresholds of tolerance for wildlife populations and the acceptability of wildlife management actions in specific circumstances will require additional investigations conducted on a case-by-case basis (Loker et al. 1999, Gigliotti et al. 2000, Miller et al. 2000, Zinn et al. 2000, Chase et al. 2002, Miller et al. 2002). The situational variables we reviewed here—wildlife species, encounter situation and management action—are general to many human-wildlife interactions, but their operation and influence will vary from one situation to another, and, in other cases, situational variables also

may be important. Dramatic situational differences can be seen in a comparison of responses to elk in Colorado communities and white-tailed deer in New York communities (Chase et al. 2002). The proportion of residents that enjoyed elk or deer “without reservation” was 65 percent in Colorado versus 11 percent in New York, and the proportion of residents that preferred deer management decisions be made by state wildlife agency personnel was 53 percent in Colorado versus 24 percent in New York. Similar situational differences were found when comparing attitudes toward management of Canada geese in large and small metropolitan areas (Miller et al. 2002). Complaints about nuisance Canada geese were lower per capita in the Chicago region than in Champaign-Urbana, a smaller urban center located in an agricultural landscape. Nevertheless, Chicago area residents perceived a higher risk of property damage and health impacts, expressed more negative attitudes toward geese, and were more likely than residents of Champaign-Urbana to believe goose populations were increasing.

Accumulating evidence about the impact of situational specifics (e.g., type of human-wildlife interaction, specific history of an individual animal) and broader human characteristics (e.g., value orientations, gender, past experience) on normative beliefs about wildlife, will improve our ability to understand and predict responses across situations. This increased ability to understand and predict relationships will help wildlife managers select standards for population levels and management actions that meet public acceptance and may avoid or reduce conflict over management decisions. More importantly, increased understanding of the reasons for differences in normative beliefs about wildlife across situations and stakeholder groups may enable managers and stakeholders to communicate more effectively and resolve conflicts more successfully.

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The Role of Educational Intervention in Community-based Deer Management

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Introduction

During the past quarter-century, white-tailed deer (*Odocoileus virginianus*) numbers have increased to unprecedented levels, particularly in areas with suburban development. Most suburban residents enjoy deer; however, many recognize the need for and expect programs for managing overabundant deer populations. The merits of lethal versus nonlethal management of suburban deer herds are often hotly debated and can be a divisive issue for many communities. Past research has shown that citizens want to participate in making management decisions that affect wildlife in their neighborhoods (Chase et al. 2002). Such situations provide an ideal opportunity for public issues education. Public issues are matters of widespread concern that grow out of accumulated daily events (Dale and Hahn 1994). They often involve controversy and disagreement that results from different roles, values, interests and ideas of affected stakeholders.

Public issues education programs are intended to enhance society's capacity to understand and address complex, often controversial, topics. Acquiring information, developing skills, building capacity and gaining new insights are part of the learning process needed to address public concerns. There

is an important role for cooperative extension educators and wildlife agency staff who wish to involve stakeholders in resource management decisions (Dale and Hahn 1994). The actual education process may have different characteristics, depending on the level of stakeholder input sought and the outcomes desired. Partnerships between community leaders, state wildlife agency staff and cooperative extension educators can encourage understanding that communities will need to effectively manage deer (Siemer et al. 2000). In this case study, we examined resident's attitudes towards several deer management approaches in the Village of Cayuga Heights, New York, before and after an extension education program. The effectiveness of different communication techniques and the credibility of extension educators also was evaluated. We highlight several essential roles of public issues educators (Dale and Hahn 1994) for resolving community-based wildlife conflicts.

Study Context

Located in upstate New York on the southern edge of the Finger Lakes Region, the Village of Cayuga Heights is a residential community, bordering the City of Ithaca, New York. The population was estimated at 3,273 (2,772 are over the age of 18) in 2000 (U.S. Census Bureau 2000).

Conflicts between deer and people, such as landscape plant damage and auto accidents, were commonly reported to officials in Cayuga Heights. In August of 1998, the Cayuga Heights Village's trustees and mayor sanctioned a citizen's committee to examine deer-related issues in the village and make management recommendations to the trustees. That committee worked closely with researchers from Cornell University, to study deer abundance and movements (Boldgiv 2001) and to study village residents' beliefs and attitudes toward deer and deer management methods (Chase et al. 1999).

The Cayuga Heights Deer Committee met 40 times between fall 1998 and spring 2001 to explore the costs, social acceptability, biological feasibility and regulatory constraints associated with potential deer management actions. Their efforts included public meetings in October 1999 and January 2001. Cornell Cooperative Extension (CCE) educators assisted with meeting organization, facilitation and development of a public involvement strategy (Siemer et al. 2000). During 1999 and 2000, CCE educators conducted an outreach program that provided information about deer management options. A CCE staff member

from the Tompkins County Association worked with the deer committee to engage citizens through news articles in the local paper, an appearance on a local cable television show and by organizing two public meetings for community residents. CCE staff from the Cornell University campus conducted additional issue education through the use of a variety of brochures, newsletters, booklets and an informational Website. CCE researchers integrated outreach information with an ongoing study of deer numbers and movement patterns in the village to inform deliberation about the biological feasibility of implementing a fertility control program for deer (Boldgiv 2001).

The public deliberation that unfolded in Cayuga Heights created an opportunity for us to question the effects of wildlife-related issue education at a local level. In 2000, CCE staff collaborated with the Human Dimensions Research Unit (HDRU) at Cornell University, to measure changes in public attitudes towards deer based on new information extended to community residents via the extension education program. This study was developed to help CCE staff learn more about the effects of their deer management outreach activities in Cayuga Heights. The study had three objectives that we will address in this paper:

- to document residents' exposure to information materials and educational experiences, developed by CCE regarding deer management in Cayuga Heights
- to assess Cayuga Heights residents' perception of the credibility of CCE as a source of information for deer management in the village
- to evaluate changes in citizen attitudes toward deer and acceptance of various deer management options following an education program, using a 1998 survey in the community (Chase et al. 1999) as baseline information.

Methods

In 1998, prior to the CCE educational efforts, HDRU staff completed a mail survey with a random sample of 550 Cayuga Heights property owners. Addresses of Cayuga Heights property owners were obtained from the Tompkins County Office of Real Property Tax Assessment. The 1998 survey had an 81 percent response rate (438) after adjustment for undeliverable questionnaires (Chase et al. 1999). The questionnaire for the 1998 survey was

designed to assess: (1) demographic characteristics, (2) experiences with deer, (3) interest, concern and attitude towards deer management, (4) sources of information about deer, (5) exposure to local media and (6) familiarity with CCE educational materials.

In March 2001, we initiated a second survey of Cayuga Heights property owners. The 2001 survey involved 895 households in Cayuga Heights. We used a mailing list provided by a Cayuga Heights clerk as the sampling frame. The list provided by the clerk represented all 895 single-family and two-family residential properties, identified by the Tompkins County Office of Real Property Tax Assessment. This list does not include apartment buildings or homeowner associations, so residents of such households are not represented in our sample. The survey response rate was 63 percent (542 of 867 deliverable questionnaires).

We used similar methods and instruments for both studies. Questionnaire recipients were instructed to have the questionnaire completed by the adult in the household with the birthday occurring latest in the year. This instruction was used to promote completion of questionnaires by a relatively even distribution of men and women. Both studies used a four-mailing approach (i.e., we sent a reminder letter to all members of the sample one week after the initial mailing; non-respondents received up to two additional mailings). Many questions were identical between both surveys. A few questions were slightly modified, and a few were added to gain additional information about the educational program. We did not conduct a nonresponse follow-up study in either case, given the acceptable level of the response for both and our intended use of the data.

To increase citizen involvement in the deer management process and to gather additional home range information for tagged deer, we developed an interactive Website to serve as an educational and research tool. Citizens were able to report deer sightings via the Website or via a telephone hotline. In addition, booklets and fact sheets on deer management options, including deer-resistant plants, repellents and fencing, were available on the Website. Several of these publications were also available at the public meeting in 1999.

Results

Space limitations prevent us from fully reporting study results here. For a comprehensive report of the analyses, see Chase et al. (1999) and Shanahan et al. (2001). We highlight the effectiveness of the public issues education program in this manuscript.

Exposure to CCE Information Materials and Educational Experience

Exposure to CCE information or educational experiences was relatively modest; however, a significant number of respondents could recall exposure. About 36 percent (n = 186) of respondents had seen a CCE booklet called *Reducing Deer damage to Home Gardens and Landscape Plantings*. About 23 percent (n = 117) had seen a booklet titled, *Managing White-tailed Deer in Suburban Environments: A Technical Guide*. Less than 8 percent (n = 39) had seen the videotape, *Whitetails at the Crossroads*, available from CCE, which was viewed at a public meeting. Less than 14 percent of residents attended one of the two public meetings concerning deer management that were cosponsored by CCE.

Despite the modest exposure to specific information sources, awareness of the deer movement study in Cayuga Heights was high. Eighty-six percent of respondents (n = 454) reported being aware of the project. This was likely enhanced by distribution of project information and refrigerator magnets (containing phone numbers and the Website URL) by deer committee members. More than 400 reports of tagged deer were received via a telephone hotline. Overall, deer reports were received from 29 percent (262 of 895) different households in the community. From February to November 2000, we received 202 deer location reports via the CCE Website. Eleven percent of survey respondents (n = 58) visited the Website. Nearly 28 percent of survey respondents (n = 146) had contacted CCE to report seeing one of the tagged deer in the movement study. The integration of the applied field research on deer ecology with the public issue education program greatly enhanced community interest in deer management and the effectiveness of both efforts.

Credibility of CCE as an Information Source

Although many respondents had not been exposed to specific CCE information materials or educational experiences about deer management, the majority of respondents viewed CCE as a fair and credible source of information (Table 1). On a scale of 1 to 5, where 1 was defined as "fair" and 5 was defined as "unfair," 83 percent of respondents (n = 363) rated CCE information a 1 or 2, and only 4 percent rated it as a 4 or 5. Facilitation of public meetings by CCE staff and CCE assistance provided to the deer committee likely contributed to the perception of fairness in the decision-making process. Likewise, CCE involvement in the applied field research and the HDRU mail surveys probably enhanced perceptions of credibility.

Table 1. Percentages of responses to the question: “I think information from Cornell Cooperative Extension about deer management in Cayuga Heights is...,” made by Cayuga Heights homeowners to semantic differential items related to the fairness and accuracy of deer management information provided by Cornell Cooperative Extension in 2001.

Total		response scale					
		1	2	3	4	5	
438	Fair	69	14	13	3	2	Unfair
420	Biased	7	4	14	16	59	Unbiased
427	Accurate	60	18	16	5	2	Inaccurate
427	Separates fact and opinion	58	21	16	3	3	Does not separate fact and opinion
437	Can be trusted	63	20	12	3	2	Cannot be trusted
434	Factual	63	20	11	4	2	Opinionated

Attitudes toward Deer and Acceptance of Deer Management Options

We found that experiences with deer problems, attitudes towards deer and preferences for deer population size remained stable after educational intervention by CCE. There was little or no change in interest and concerns about deer in Cayuga Heights between 1998 and 2001. In both years, the majority of community members expressed some interest in watching deer near their home or seeing deer in the village but no interest in photographing, feeding and hunting deer. Over 80 percent of respondents both years reported damage to flower gardens, trees or shrubs.

Preference for deer population size in Cayuga Heights remained stable. The vast majority of respondents in both years wanted a decrease in deer, few wanted no change, and very few wanted more deer. Repeated questions between the 1998 and 2001 surveys indicated that the acceptability of various deer management options experienced little or no change.

In the latter part of the 2001 questionnaire, we provided more detailed information about deer management alternatives (i.e., cost, effectiveness, potential time to population reduction), then asked again about their acceptability. Introducing more information shifted respondents’ perceptions of acceptability. For example, approximately 18 percent more respondents (15% vs. 33%, n = 511) indicated that selective culling was very acceptable following a series of short descriptive paragraphs on the comparative costs and effectiveness of methods for managing deer population. The proportion of respondents who indicated that birth control for deer (contraception or surgical sterilization) was “very acceptable” fell from 55 percent to 29 percent (n = 507) after more information was provided.

In 2001, the majority of respondents (71%, n = 485) expressed a willingness to permit the darting and immobilization of deer on or within 500 feet of their residential property. Fewer were willing to allow use of biodegradable bullets to induce abortion (14% “very acceptable,” n = 503). About 44 percent of respondents (n = 500) expressed a willingness to permit deer to be shot within 500 feet of their residence, as part of a culling program. About one in three (34%) indicated that they would be willing to permit deer to be shot on their residential property.

Discussion

Although public issues education programs have the potential to enhance the decision-making environment, our findings suggest they are unlikely to cause major shifts in citizen’s core attitudes and values towards deer management in their community. The effectiveness of an educational campaign may be limited by access to media, available resources and competition with other issues on the public agenda. Still, one of the primary benefits of issue education is enhancing the quality of “public judgment” (Yankelovich 1991:5). Public judgment is a form of public opinion that includes more thoughtfulness, weighing of alternatives and accounting for a wider variety of factors than expressed in ordinary public opinion polls. Participants consider the normative and ethical side of issues, along with scientific information and facts. In this case, public involvement was needed to give deer committee members enough confidence to move forward with a management recommendation. Even if issues education did not have demonstrable effects in terms of attitude change, the resilient voice for action from survey respondents was sufficient support for the committee to recommend a reduction in deer abundance.

The consistency in attitudes expressed in 1998 and 2001 is not surprising. While the deer committee made extensive efforts to encourage community-based decision making in Cayuga Heights, there has not been the singular event that often drives large shifts in attitudes. The abundance of deer and the frequency of deer-related conflicts did not change dramatically. Although CCE education activities in this case exceeded what is normally done in communities, the overall effort might still be characterized as modest.

In contrast to the modest community-wide education program, CCE educational efforts for the small group of citizens serving on the deer committee

were extensive (Siemer et al. 2000). Participants in the deliberative process dug deeply into the issue, even if the discussion that occurred within that small group of citizen volunteers did not extend to the village residents as a whole. Interviews with deer committee participants suggested that the processes used in Cayuga Heights developed community capacity, strengthened working relationships and helped the community progress toward deer management actions (Siemer et al. 2000).

CCE staff played several, critical roles in the issue education program (Table 2). Delivering such a program is resource intensive. However, the benefits received make education efforts like this one worth considering even if they do not create immediate change in public opinions about deer in the wider community.

Table 2. Summary of the roles, activities and impacts of the issue education program conducted by Cornell Cooperative Extension staff in Cayuga Heights, New York, 1999-2001.

Role of educator	Staff member	Program activities	Program output	Impacts in the community
Convener	County educator	Helped deer committee come together	Organized meetings; provided staff support for mailings; provided background information on deer damage management	Enhanced committee's capacity for learning
Program planner	County educator	Assisted with development of the deer committee's stakeholder engagement program	Added three new members to the deer committee to increase the stakes represented; developed a protocol for dealing with the media	Exposed committee to a wider diversity of interests; print media about the committee was relatively accurate
Process facilitator	County educator	Facilitated deer committee and public meetings; created a process for broader public input and joint fact finding; developed a protocol for implementing public meetings	Held 40 meetings of deer committee; held 2 public meetings on deer management in the community	Fair and credible perception of process, leading to trustee adoption of recommendations; positive and useful perception of experience by committee members and wildlife agency staff (Siemer et al. 2000); enhanced relationships between the community and wildlife agency (Siemer et al. 2000).

Table 2. continued

Role of educator	Staff member	Program activities	Program output	Impacts in the community
Information provider	State wildlife specialist	Held workshops on deer damage management; distributed informational bulletins; contributed to newspaper articles; appeared on a local cable television program; conducted two deer ecology studies. Served the deer committee at multiple meetings. Co-sponsored a mail survey of community residents. Provided technical information at public meetings.	Over 225 residents served at deer workshops; deer movement patterns quantified; deer population level estimated; resident's deer-related attitudes and experiences were quantified; less than one third of residents exposed to CCE educational materials; 8-14% of residents attended a public meeting on deer management; 262 of 895 homes reported tagged deer >600 deer sightings reported in first year; 11% of community residents used the Website to report deer or get information	Empowered deer committee with information needed to sustain thoughtful community deliberation (Siemer et al. 2000); fair and credible perception of CCE as an information source; stable attitudes toward and preference for deer population size after educational intervention
	Extension associate	Maintained a Web-based system for collecting information on deer sightings, and a deer report telephone hotline.		Fair and credible perception of CCE as an informational source

The lessons learned in this case provide an example of one useful approach to community-based deer management (Chase et al. 2002). Individuals in the community did not need to change their strongly-held attitudes and beliefs in order to make progress toward resolving deer management concerns. However, including participants who represented a wide range of attitudes and values toward deer was essential for the public involvement process to be perceived as credible and fair (Susskind and Cruikshank 1987). Curtis and Hauber (1997) highlighted that community consensus may be an unrealistic expectation for controversial wildlife management situations that include such a diversity of stakeholders and opinions.

The issue education process ultimately resulted in the deer committee recommendation to the village trustees to implement an experimental fertility control program for deer. The Cayuga Heights trustees endorsed the report and applied to the New York State Department of Environmental Conservation for authorization to conduct the research project. The state wildlife agency approved a permit for deer capture and sterilization in the village, and it provided funding for a graduate student to model deer population ecology and potential effectiveness of the sterilization program. A donor in the community covered the costs and provided the equipment needed for deer sterilization. This field research is ongoing, so the overall success of the management action is yet to be evaluated.

Management Implications

State wildlife agency and cooperative extension staff should support public issues education programs with information resources and experts in both the natural and social sciences. Having wildlife management and human dimensions expertise from specialists outside the state wildlife agency would be an asset to many communities (Siemer et al. 2000). It will take time for community leaders to develop the capacity to deal with local, controversial wildlife issues. Skilled third-party facilitators can help communities expand stakeholder representation, establish fair and credible decision-making processes, and enhance shared knowledge for making resource management decisions.

Deliberation in achieving a collective purpose, relationship building and commitment to a management action are key elements in community-based management for wildlife (Schusler et al. 2000). Stakeholder involvement is occurring with greater frequency and becoming the norm in many situations (Chase et al. 2000). It is important to emphasize that the process by which decisions are reached plays a crucial role in shaping public perceptions of those decisions (Decker et al. 2002). As the complexity of wildlife issues increases, comanagement approaches—those in which the responsibility for management is being shared by wildlife agencies and stakeholders—are more often used (Schusler et al. 2000).

Decker et al. (2002) noted the acceptance of management actions (e.g., culling, special hunts, fertility control) conducted by the wildlife agency is based, in part, on stakeholder concerns about impacts caused by wildlife and on the potential impacts of the wildlife management actions themselves (e.g., discharge

of firearms at night, lost darts with fertility control drugs). Community agreement with a management outcome, such as lowering deer abundance, does not necessarily indicate stakeholders will agree with the management action needed to accomplish that outcome. Reaching agreement on suitable wildlife management techniques is often the most difficult part of the deliberation and negotiation process for stakeholder groups.

Agency credibility and image, and stakeholder perceptions of the process used to develop a management strategy, are vital to resolving community-based wildlife issues (Decker et al. 2002). In this case, CCE staff received high scores for credibility, fairness of the deliberation process and sharing information with the public (Table 1). Meaningful stakeholder involvement is critical for improving any of these components (Chase et al. 2000), and it is especially important for appropriate public judgment concerning controversial management situations. State wildlife agencies involved with similar cases should consider communication methods for enhancing their credibility and image with key stakeholder groups. Also, it will be important to determine if agency staff or independent facilitators will be needed to accomplish the primary roles (Table 2) in a public issue education program.

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Black-tailed Prairie Dog Management in Urban-Suburban Settings: Opportunities and Challenges

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Introduction

Among the many human-wildlife conflicts that occur across North America, some of the most contentious occur at the interface of urban and suburban lands and adjoining rural landscapes. Along the Colorado Front Range,

one of the more difficult situations faced by local governments and municipalities involves black-tailed prairie dog colonies. These colonies are relicts of the expansive colonies that once occurred across much of the prairies of North America. Although these colonies are relatively small and, usually, highly fragmented, they represent an important link to our natural history, provide a valuable wildlife-viewing experience and allow the promotion of public education about intact prairie ecosystems and their components. Some of the colonies, especially if eventually linked to other nearby ones, may help to prevent the federal listing of the black-tailed prairie dog as a threatened species and may play a role in the recovery of the black-footed ferret, perhaps the most endangered mammal in North America. Additionally, many of the urban-suburban colonies are being used by many of the wildlife species associated with prairie dog colonies. Most of these colonies are continuously under the threat of development or other disruptive human activities. On the other hand, as the colonies expand, there are conflicts with adjoining landowners who suffer damage to vegetation, damage to property by burrowing and gnawing, and the potential threat of plague exposure during outbreaks.

The people living along the Colorado Front Range represent many walks of life, and they vary tremendously in their perspectives, experiences and backgrounds. There is considerable variation in how they think the prairie dog situation should be handled and many special interest groups are very vocal in expressing their views, promoting their agenda and showing little interest or tolerance in the views or concerns of other groups or individuals. Yet, in theory, everyone has something to contribute, and it is essential to have the diversity of viewpoints represented if conflict resolution is to be achieved. Meanwhile, the various governmental agencies involved with prairie dogs in one way or another usually have differing objectives, authorities and available resources.

We felt that an informational, interactive forum was needed to provide the essential background information to interested parties and participants to level the playing field and to provide local governments and municipalities with the information and contacts that they needed to make better management decisions related to prairie dogs within their jurisdictions. A technical workshop was conducted in February 2001. The workshop was cosponsored by the U.S. Fish and Wildlife Service, U.S. Department of Agriculture-Wildlife Services, Colorado Division of Wildlife, EDAW Inc., Boulder County, Boulder and Fort Collins. Each of the sponsors had representation on the organizing committee.

The purpose of the workshop was to provide a forum to update municipal, county, state and federal employees, who are responsible for prairie dog management and decision-making, on a broad array of topics (Table 1). We also wanted the diverse viewpoints people have towards prairie dogs to be represented at the workshops, so agency personnel (and everyone present) would be aware of the views of their constituents and fellow citizens. Specialists and persons representing groups interested in—or potentially affected by—prairie dog regulation and management were invited to make presentations and provide a forum for interaction between managers, researchers and other involved parties, including the audience. Abstracts of oral presentations and posters, along with contact information and other, general information, were compiled in a workbook and distributed to all attendees as a future source of information, with the hope that partnerships would be formed to address the conflicts and potential solutions in the spirit of cooperation in the future. Based on the positive feedback of attendees and the requests for more information and updates on prairie dog status and management, we conducted the second workshop in February 2003. We provided an in-depth summary of the informational needs and issues in several key, topical areas, based on the first workshop (Witmer and Hoffmann 2002).

In this paper, we discuss some aspects of the workshops and our efforts to make them more successful. The ultimate measure of success will be in the partnerships formed and in the maintenance of abundant, healthy prairie dog colonies along the Colorado Front Range with reduced conflicts with humans. The achievement of success will require the careful, combined management of prairie dog populations and habitats, but also the “management” of people.

Setting the Stage: Presentation of Background Information

Workshop attendees were updated on the legal status and conservation activities surrounding the black-tailed prairie dog since the National Wildlife Federation’s petition proposing its listing under the Endangered Species Act (Graber and France 1999). The U.S. Fish and Wildlife Service (FWS) issued a “warranted but precluded” declaration on the species (US Fish and Wildlife Service 2000) and encouraged state, tribal and federal agencies (and others) to work together on conservation plans to restore the species, so it would not need to be listed at a later date. This resulted in a considerable interstate effort and the formation of the Interstate Prairie Dog Conservation Team. Most of the states

Table 1. Topics covered in the Colorado Front Range Prairie Dog Technical Workshop (February 2001) and the Colorado Front Range Prairie Dog Technical Conference (February 2003).

Conservation	Biology/Ecology	Public Attitudes	Habitat and Vegetation Management	Population Management	Plague Management	Landowner Incentives
Status and range	Social behavior	Survey results	Habitat management tools	Conflict resolution	Exotic disease	Need for private lands
Ecosystem role	Reproduction and mortality	Opposing views	Vegetation impacts	Zoning	High susceptibility	Landowner rights
Proposed listing and findings	Population fragmentation	Knowledge levels, public education	Noxious weeds, native plant restoration	Relocation, natural predation	Prediction, management of plague	Economic incentive programs, NGO roles
Strategies	Dispersal, genetic variation		Barriers	Toxicants	Research needs	
Federal, tribal, state, private roles	Vegetation relationships					

involved signed a cooperative memorandum of understanding (MOU) with this group and participated in the drafting of a range-wide Conservation and Assessment Strategy (CAS; Van Pelt 1999). Many states began their own working groups, with public sector and stakeholder representation, to address the issues within their state. Meanwhile, the tribal governments, rather than becoming members of the interstate team, formed the Intertribal Prairie Ecosystem Restoration Consortium. The states and tribes began to work on Candidate Conservation Agreements with Assurances (CCAA) with the FWS.

There are also many conservation planning activities being conducted at the municipal and county levels. These governmental bodies are faced with many challenges because of the small sizes of properties and the frequent interface of urban/suburban/rural properties with very different stakeholders, attitudes and land uses. These governmental bodies often use the task force approach to identify stakeholders, problems and potential solutions to prairie dog issues that result in policy and management documents. Issues, options and activities at the municipal and county levels were summarized by Witmer et al. (2000). Again, the main objective of our technical workshops was to provide the basic informational needs of local governments of the Colorado Front Range to enable them to better deal with prairie dog issues.

Several speakers addressed the biology and ecology of prairie dogs because it is very important that managers and citizens have a good understanding of these topics before management plans and decisions are made. Prairie dogs live in colonies with a relatively complex social structure. Within a colony, there are coterries (extended family units), defining a dominant male's territory. It has been determined that, for rodents, prairie dogs have a relatively low reproductive rate. They also have high mortality rates because of infanticide, plague outbreaks and predation. Despite this, there are numerous examples of rapid expansion rates of colonies once protection is provided (e.g., Fagerstone and Ramey 1996). When detailed surveys are completed, it is often found that many more acres are occupied than had been originally estimated. Most populations are highly fragmented (i.e., metapopulations exist), and biologists fear that genetic variation may be low in these small, isolated populations. Studies have determined, however, that, because of the breeding strategy and good dispersal capabilities, most prairie dog populations maintain moderately high levels of genetic variation. Conservation biologists have conducted population viability analyses and are integrating reserve size and design considerations to provide essential information

to help assure population viability (i.e., to reduce the risk of extinction) despite the metapopulation situation. There has been heavy reliance on the book on the black-tailed prairie dog by John Hoogland (1995) and his other scientific publications for information on the biology and social ecology of the species. Hoogland and numerous other workshop speakers are currently working on an updated book that will include chapters on many other topics, such as prairie dog conservation and management.

Several speakers addressed the effects that prairie dogs have on vegetation and ground cover both by foraging and by clipping plants to maintain a more open setting to reduce predation. Many persons mistakenly believe that prairie dogs live harmoniously with prairie vegetation, that a status quo exists. Speakers informed the attendees of some of the issues and difficulties of vegetation management on occupied sites. There can be shifts in plant species composition with forbs replacing grasses, unpalatable species replacing palatable species, reduction in shrub cover because of stem girdling and the loss of some plant species. There may be more plant cover overall, but it is only reduced litter and ground cover, contributing to the erosion of soils. On the other hand, some rare plant species may survive on the mounds of prairie dogs. Although lower of stature, some plants may have higher nutritional levels because of the continuous grazing and clipping. This may have resulted, historically, in the attraction of large, grazing herbivores to prairie dog colonies. The picture with nonnative cattle is less clear and there is a continuing concern by ranchers that prairie dogs remove too much livestock forage.

People Management

Presentations of the results of attitude surveys regarding prairie dogs add an important perspective for workshop attendees. A number of surveys have been conducted, both within individual states and on a regional basis. These surveys reveal the many dichotomies in attitudes and the polarized nature of the issues. They also reveal the relative lack of knowledge of the general public about prairie dogs. Typically, rural landowners and persons living near active prairie dog colonies have more negative attitudes towards prairie dogs than urban dwellers and wildlife conservation activists. Persons that live near prairie dogs or are wildlife conservation activists tend to be more knowledgeable about prairie dogs. Persons more knowledgeable about prairie dogs often support more holistic

management of colonies, including some lethal control and not sole reliance on relocation as a solution to conflicts. Speakers representing segments of society (such as farm bureaus, cattleman's associations and home builders associations) most directly affected by prairie dogs and prairie dog listing and regulations were important contributors to the workshop.

The results of the surveys suggest the need for public education on matters concerning prairie dogs, their ecology and habitats, their role in the ecosystem, and the management issues and challenges faced by managers, land owners and health officials. People management can also result in more cooperation of landowners in prairie dog management and better acceptance and support for management policies and plans. There are many outlets available educating and involving the public. During the workshops, we also used breakout sessions, so panels of specialists could address specific management areas and allow audience participation. Finally, we presented the opportunity for workshop participants to attend a field trip to a nearby suburban prairie dog colony to view and discuss ongoing management and issues.

Another important part of people management is provision of incentives to landowners to provide land for prairie dog colonies and to be more tolerant of adjoining colonies. Because most of the current and former range is in private land ownership, it is essential to obtain the cooperation of landowners in the restoration of the prairie dog. This poses several challenges. Partly because rural economies are not strong across the country, much rural land is being converted to types of development (residential and commercial) that are not compatible with prairie dog colonies. Additionally, it is not easy to change the negative attitude that many rural landowners have towards prairie dogs. Landowners need economic incentives (e.g., compensation, tax relief) if they are to restrict the uses and productivity of their lands to accommodate prairie dogs. Incentive programs must have an adequate source of funding for cost-sharing to enhance the economic productivity of the private lands in the program. Many incentive programs involve land use leases or easement agreements. Several federal programs, mostly under the Farm Bill, are potential sources of assistance for private landowners. Several states within the historic range of black-tailed prairie dogs have begun incentive programs of their own.

Even nongovernmental organizations (NGOs) have begun programs, such as the Prairie Partners Program of the Rocky Mountain Bird Observatory. Other examples of services that NGOs can provide towards restoration of black-

tailed prairie dog populations include monitoring populations and trends, assisting the formulation of policies and development and implementation of management plans, devising mitigation banking frameworks, conducting research and public outreach, and consensus building. Thus, the private sector can provide valuable services to agencies and landowners in their efforts to conserve and manage prairie dog colonies.

Habitat and Vegetation Management

Several speakers addressed the importance of habitat, especially vegetation management on prairie dog colonies. The habitat occupied by prairie dogs can be managed in various ways, depending on the location and ownership of the property, the size of the parcel, the land manager's or owner's objectives, and the surrounding land uses. On federal and state lands, managers often use techniques, such as prescribed burning, managed livestock grazing, barriers between public and private lands, and land exchanges, to manage prairie dog colonies to reduce conflicts.

With protection, prairie dogs seem to thrive, even on urban-suburban sites with abundant noxious, nonnative weed cover. The animals may even encourage weed invasion and expansion by selective foraging on palatable native plant species. On the other hand, nonnative plants do not withstand the grazing by prairie dogs as well as native prairie plants; hence, the vegetation on some sites may degrade more quickly. It is difficult to control noxious weeds on occupied prairie dog sites, even with herbicide. Thus, it is difficult to practice integrated weed management and reduce herbicide use. The situation greatly hinders attempts to restore native prairie plant species, even with the use of weed control, seeding and irrigation. In some cases, managers remove the prairie dogs from the site, then attempt to restore native prairie plant species with the intent to reintroduce the prairie dogs at a later date. It is not known how much time native plants need to establish themselves before they can withstand prairie dog grazing.

Because prairie dog colonies can expand and cause conflicts with neighboring landowners, it is often necessary to contain the colony or to reduce colony expansion. Plastic barriers are a popular approach to the reduction of prairie dog-landowner conflicts because barriers, theoretically, provide a nonlethal solution to colony expansion. Barriers are often less attractive to resource managers because of their expense and high maintenance

requirements. Barriers are subject to sun, wind, erosion and animal (chewing and clawing) damage, and they are also considered unattractive to some members of the public. Generally, barriers are breached by some prairie dogs which burrow under or climb over the barrier, resulting in active burrow mounds outside the barrier. These individuals must then be removed and the burrow entrances plugged. Vegetative barriers, using shrubs, are difficult to establish and maintain because of the dry conditions of the prairie landscape and because of animal damage. Again, some prairie dogs will readily pass through the vegetative barriers. Information was provided on barrier construction and maintenance at the workshop.

Prairie Dog Population Management

Resource managers are often faced with the challenge of having prairie dogs populations where they don't want them, and of not having them where they do want them. Additionally, even in places where the managers have prairie dogs where they want them, the colonies often require control as they expand into bordering properties where conflicts arise. As such, a zoned management approach is often used once a planning activity is completed and a management plan developed and adopted.

In most situations, managers rely heavily on relocation and population control as parts of their management plan. Both of these approaches, however, present many challenges and these were addressed by workshop speakers and panelists. In particular, resource managers and landowners need to be aware of the many ordinances, regulations and laws that agencies, county commissioners and legislators have enacted on the local, county and state levels to dictate what can and cannot be done with prairie dog colonies.

Relocation is used to restock areas where prairie dogs are desired, but there are no nearby occupied areas to provide a founder population or because natural dispersal from nearby occupied areas is too slow or unsuccessful in establishing new colonies. Relocation is also used to remove excess individuals from expanding colonies, so the expansion does not result in land-use conflicts or increased human health risk from plague. Finally, relocation is used in an attempt to remove all individuals from an occupied area that is scheduled for development. Although lethal control can be, and often is, used in these latter situations, many prefer a nonlethal approach, i.e., relocation. Additionally, in some cases,

unwanted prairie dogs are used as a food source and for predation training for captive-reared, black-footed ferrets that are scheduled for use in reintroduction projects.

There are many considerations to assure the success of a relocation effort (Truett et al. 2001). An appropriate site must be found that is ecologically suitable and will not result in land-use or legal conflicts. It is best if the site has been previously occupied by prairie dogs and old burrow systems still exist. Otherwise, considerable site preparation may be necessary. This could include reducing vegetation height, drilling starter burrows and predator (e.g., coyote, fox) management. With a selected site ready for animals and the appropriate permits in hand, the prairie dog capture work can begin. Live-trapping is usually time consuming and expensive, especially when the objective is to capture and move every individual of the source population. Some private environmental consulting firms, wildlife conservation organizations or animal control companies will provide relocation services. Workshop attendees were given a list of resources and vendors where services and supplies could be obtained. A real challenge to managers has been to locate adequate numbers of suitable and acceptable sites for relocation efforts. Adequate landowner incentive programs may help resolve that situation.

Natural predation can be encouraged by the creation of artificial perches for use by raptors in an effort to slow colony expansion into neighboring ownerships. In some cases, nest boxes are also placed near colonies on poles or perches. These measures are taken because perches and nesting cavities are often in short supply on the prairies. Resource managers have also experimented with the placement of hay bales to provide cover and protective habitat for mammalian predators. While these structures are sometimes used by predators, it has not been established that the increased predation limits colony expansion.

Several toxicants, registered by the U.S. Environmental Protection Agency, help to control or to eliminate prairie dog populations where serious conflicts occur or development is to begin. These include the fumigants, aluminum phosphide, gas cartridges and zinc phosphide, a rodenticide. Workshop attendees were provided an overview document of the use of toxicants in prairie dog management. Private animal damage control companies are usually licensed to apply toxicants for rodent control and can be contracted to provide that service. The use of toxicants remains very controversial in the public sector, resulting in many agencies being reluctant to use this tool.

There have been several fertility control trials, dating back to 1983, to test the potential of chemical solutions to prairie dog population control. While some of these trials showed promise, there are many difficulties to overcome before these tools become available, including the need for a remote delivery system and the need to get a federal registration that would allow the use of the compounds in the environment, especially given that they would probably not be species-specific in their effect.

A Big Challenge: Plague and Its Management

An important health consideration where prairie dog colonies occur at the urban-suburban interface is bubonic plague (plague). Plague is a nonnative disease caused by the bacterium, *Yersinia pestis*. Prairie dogs are very susceptible to this disease and mortality rates are nearly 100 percent in infected colonies. Currently, plague is considered the wild card of prairie dog colony viability and, relatedly, a major hindrance to the successful reestablishment of black-footed ferrets (Antolin et al. 2002). There are also health concerns for humans and their pets where prairie dog colonies, which may become infected with plague, occur near suburban housing developments, schools, and city and county parks. We need to know more of how plague is transmitted between colonies, the ecology of insect vectors and the possible role of other wildlife vectors. This information would allow us to better predict and manage plague outbreaks. Research is underway on efficient and effective ways to prevent or slow plague outbreaks by the use of insecticides on burrow-dwelling fleas. Other research is directed at development of an oral vaccine for plague that could be placed in colonies for consumption by prairie dogs. Meanwhile, managers can educate the public on the use of flea collars on dogs and cats, monitor colonies for plague outbreaks, post warning signs when outbreaks occur and, in some cases, apply insecticides to burrow openings when an outbreak starts in an attempt to slow or stop the outbreak and potentially save the colony.

Summary

Resource managers face many challenges in providing for the needs of prairie dogs as an important prairie ecosystem component. While many of them would like to avoid federal listing of the species, they must also resolve the

conflicts that arise between humans and prairie dogs. Technical workshops provide essential information and updates to these resource managers and other interested parties, so the agencies, parties and landowners can better work together to find and implement solutions to provide for the needs of the species, the prairie ecosystem and human neighbors of those areas. Impressive progress is being made through the many cooperative efforts throughout the range of the black-tailed prairie dog. This is a shifting arena; however, periodic, updated information transfer is essential to the needs of resource managers and landowners alike. Continued research is needed to provide additional tools and answers to difficult questions that will allow us to resolve the conflicts between prairie dogs and urban-suburban communities. Upon request, we will provide interested persons with contact information on the various specialists and parties that have been involved in the workshops, vendor information and access to pertinent literature on specific topics.

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Be Bear Aware

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Two years ago, Duane Shroufe, Director of Arizona Game and Fish Department, Larry Bell, Director of New Mexico Department of Game and Fish, and Eleanor Towns, past Regional Forester for the Southwestern Region of the Forest Service, recognized that black bear and human encounters were escalating in New Mexico and Arizona. They formed an interagency team to identify ways to reduce the risk to people and bears.

This afternoon I will give you a brief background of the Be Bear Aware Program, what the team developed and how members of the International Association of Fish and Wildlife Agencies can help.

Media are full of images showing that it is okay to get close to wildlife and that close encounters are just wonderful. As wildlife professionals, it is our responsibility to help the public understand that close encounters are not in the best interest of their safety, nor are they in the interest of wildlife. These are not necessarily wildlife biologists delivering this message. Many are just trying to sell a product without any personal responsibility or legal culpability if a member of the public is injured. The phone calls and lawsuits are directed to the agencies, not the media.

Resource agencies want the public to have safe and enjoyable outdoor experiences, but, unfortunately, as the pictures you just saw portray, it is often only the sensationalized, irresponsible messages that the public sees. The underlying message that the media sends is that it's fun and okay to get close and personal with wild animals, including bears. Over \$100 million dollars is spent on these media messages, and, as biologists, we know that, when people get close and personal with wildlife, there will be incidents.

What are we doing about this in the Southwest? We are working on a program to get correct messages to the public and change the perception that it

is okay to get close and personal with wildlife. Our partners have been New Mexico Department of Game and Fish, the Arizona Department of Game and Fish, the Center for Wildlife Information, the Sandia Mountain Bear Watch, Philmont Scout Ranch and the U. S. Forest Service.

Black bear populations in New Mexico, based on a recent study, are stable or increasing. At the same time, gateway communities, those adjacent to the forests, are also growing. The lack of acorn and other mast crops due to an ongoing drought, cause the bears to increase their range in search of food. As a result, there have been more interactions between black bears and humans in the past few years than ever before.

Bears easily become habituated to humans, especially if there is food available. Bears lose much of their natural avoidance as they are around more and more people. Our concern as biologists is that, because of the media messages given to the public, we will see more human-bear conflicts. We are trying to get the message out that it can be dangerous to get close to wildlife and that the public can enjoy viewing the natural behavior of wildlife from a safe distance.

What can we learn from these types of situations? We can, and must, communicate with each other in a timely manner. We have to store and dispose of waste better. We have to improve coordination in locations where people and bears share the same areas. The U. S. Forest Service identified a point of contact on each national forest in Arizona and New Mexico to coordinate messages and materials for the public and employees. Resource agencies can help by designating a person to coordinate between agencies to ensure education materials reach the public. Agencies must review their policies and regulations to make sure the information is accurate, appropriate and consistent between and among agencies.

In the last few months, the Be Bear Aware program expanded to include: The Wildlife Society, Wildlife Management Institute, International Association of Fish and Wildlife Agencies, Western Association of Fish and Wildlife Agencies, and Southeast Association of Fish and Wildlife Agencies. Together, we are developing and sharing consistent messages on wildlife, and we are developing training and educational plans and programs. A national action plan to help coordinate our efforts was jointly developed. Copies are available at the back of the room and at the Be Bear Aware booth.

Members of The International Association of Fish and Wildlife Agencies are asked to listen for and challenge media messages that encourage the public

to get close to wildlife. Join in the campaign to assist the public in understanding the importance of safe behavior when hiking, camping and living in bear country.

A large part of effective wildlife management is effective people management. The Be Bear Aware Program provides needed tools to be effective managers.

Bears and Moose in Massachusetts: The Past, the Present and the Future Possibilities

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Populations of large, wild animals have increased in suburban and urban areas in recent years. White-tailed deer (*Odocoileus virginianus*) have demonstrated the ability to adapt to high levels of human development and this adaptation has generated discussion about how best to deal with overabundance (McShea et al. 1997, Warren 1997). This is a problem wildlife managers have had some difficulty coming to terms with and solving. North American wildlife management has been centered on a model of restoring and increasing populations, and it is governed by conservative management of populations (Geist et al. 2001). Thus, deer overabundance and the accompanying issues were not widely recognized until the problems became polarizing and nearly intractable.

Other large mammals now seem to be following the same population trajectory as deer (Organ and Ellingwood 1999). In Massachusetts, moose (*Alces alces*) and black bear (*Ursus americanus*) populations have increased as have conflicts with humans in urban areas. With moose, the primary conflicts are vehicle collisions and the threat to human safety this poses; with bears, a variety of conflicts have developed, ranging from extensive crop damage to home invasions. Massachusetts is the third most densely populated state yet is greater than 60 percent forested, and most of the human population lives in the eastern third of the state (Deblinger et al. 1999). Central and western Massachusetts are more extensively forested with pockets of urban and suburban areas.

Concurrent with the rising populations of large mammals has been a growing societal antipathy toward hunting. Animal rights groups often advocate for individual-based strategies for dealing with human-wildlife conflicts. Despite many attempts to use other techniques to control overabundant deer populations, only hunting has consistently been successful when applied to free-ranging populations. In general, moose are not yet common around urban areas in the lower 48 states, except as discussed below. Thus, lack of hunting has yet to be a major concern. Black bears, however, are at record levels of abundance in many parts of North America, and several attempts to reduce or prevent bear hunting seasons

and limit techniques have been successful in recent years (Organ and Ellingwood 2000, Carr 2001). Limiting the use of public hunting for these species is the wrong approach if they are to remain valued by society (Geist et al. 2001).

My objective is to use Massachusetts as a real-world case study for the potential management of large mammal populations in urban or exurban areas. It is critical that management of large mammals be at the population-level rather than the individual-level, and this can only be achieved using regulated public hunting. The experience of deer management should provide ample warning for biologists to not allow black bears and moose to repeat the same scenarios. Further complicating population management in Massachusetts is a declining trend in hunter numbers and increasing development of the landscape, which reduces hunter access (McDonald et al. 2002). These trends make early action even more important.

Massachusetts Large Mammals—Moose

Moose mortalities, a rough index to overall moose numbers, have steadily increased in recent years (Woytek 2002; Figure 1) from less than 5 per year in 1990 to 32 in 2002. Since 1992, there have been 180 known moose mortalities in Massachusetts. Early in that period, most mortalities occurred during early fall as young males traveled south during the breeding season (Vecellio et al. 1993). More recently, much moose activity has been documented during spring as yearlings disperse from their natal areas (McDonald 1999). Many sightings are reported each year of bull-cow groups in fall and cow-calf groups in spring and summer, demonstrating a reproducing population across most of the state, with the exception of southeastern Massachusetts. Moose hunting is prohibited by statute.

Massachusetts Large Mammals—Black Bear

Massachusetts has been conducting field research on black bears since 1980. Mark-recapture studies and subsequent population modeling have consistently indicated about an 8 percent annual rate of growth and a current population well over 2,000 bears. All forms of mortality typically remove about 50 percent of the annual productivity, with known hunting mortality being the largest component of that (Figure 2). Thus, mortality would have to double, and hunting-related mortality more than double, assuming nonhunting mortality stays at a constant proportion, to stabilize the population.

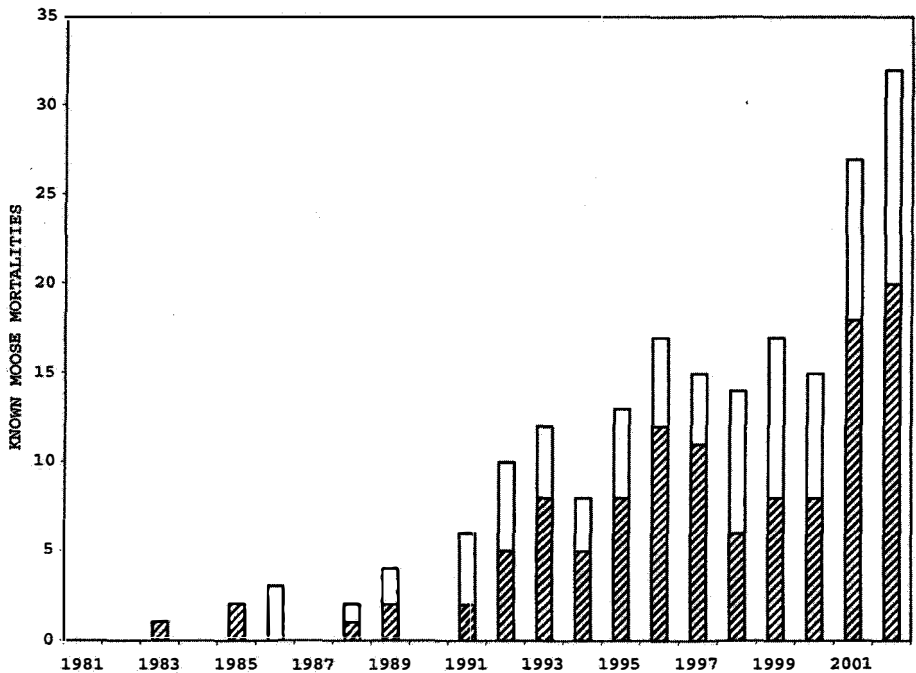


Figure 1. Known moose mortalities in Massachusetts, 1981–2002. Hatched portion of bars represents road-killed moose, open portion of bars represents all other known mortalities.

No limit is placed on the number of inexpensive (\$5.00) bear hunting permits available each year; although, hunters may only purchase one per year. Permits sales have remained relatively stable in recent years, between 1,850 and 2,650, and about 75 percent of permittees actually hunt each year (McDonald et al. 1995). Hound hunting was prohibited by a ballot referendum in 1996; baiting was also outlawed by that referendum but had been prohibited by regulation since 1970. The split September and November bear hunting season was increased in 2000 from 12 days to 23 days, with 17 of the days in September when greater than 90 percent of the harvest typically occurs. The harvest has increased with the increased number of days, but harvest appears to be driven primarily by the availability of natural foods (McDonald et al. 1995). When natural foods are scarce, bears use cropfields and other human food sources more extensively and are more vulnerable to stand hunters in those areas. Thus, simply extending the hunting season will not likely increase the harvest enough to stabilize the population in most years.

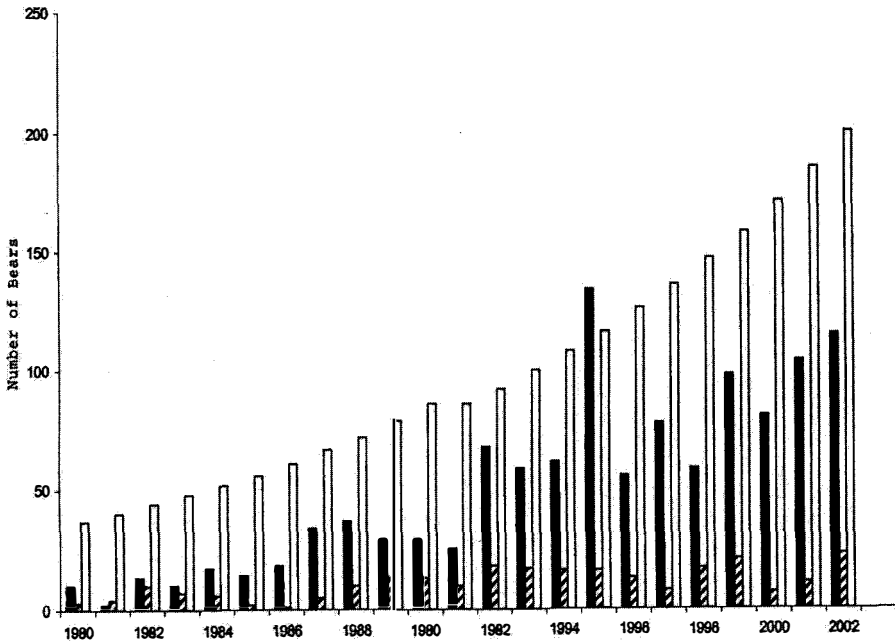


Figure 2. Black bear harvest (solid bars), other known mortalities (hatched bars) and additional number of black bear removals necessary to stabilize population (open bars), assuming 8 percent annual growth, Massachusetts, 1980–2002.

Individual-based Management of Large Mammals

An adult male moose was shot, in 1991, in front of a crowd of people and television cameras in the suburban Boston town of Natick, which led to an interagency protocol for dealing with large mammals in urban settings. This protocol was agreed to by the Massachusetts Division of Fisheries and Wildlife (DFW), the Massachusetts Division of Law Enforcement, the Massachusetts State Police and the Massachusetts Society for the Prevention of Cruelty to Animals. It laid out an incident command structure, situational priorities and appropriate actions to be taken by personnel, depending on the situation. The actions included simply monitoring animals along rural roads, closing roads and hazing animals away from danger, chemically immobilizing and relocating healthy animals, immobilizing and destroying injured animals, and shooting animals posing as immediate threat to public safety.

The protocol worked well in most cases as personnel developed rapport with each other and the media. Annual training sessions were held for personnel

to understand how to handle certain situations and to be up-to-date with equipment technology. Although not a major consideration, the costs of responding to urban large mammal events could be high, as other states have reported (Eriksen 2001).

Despite a workable protocol for dealing with large mammals in urban areas, the number of those events increased. In 2002, at least eight bears were shot in close proximity to houses, more than in any previous year, drawing a measure of public criticism. Local officials, citizens and newspapers in western Massachusetts requested that DFW consider more aggressive population management strategies for bears, including repeal of certain aspects of the 1996 referendum, to reduce these front-porch encounters. In other cases, moose were shot and again the system for dealing with large mammals was questioned by the public. This type of protocol is clearly necessary when large mammals coexist with people. However, such an individual-based strategy is not management, it is simply response and will not decrease the problems.

Public Education Campaigns

Information and education (I&E) campaigns are often the first action taken to raise public awareness of wildlife issues. I&E programs include preparing informational pamphlets, eye-catching bumper stickers and short videos for public distribution to get a certain message across. Sometimes, specific measures can be employed; for example, erecting moose-crossing highway signs in areas of documented moose activity to boost awareness. Biologists may also embark on public speaking tours to connect with citizens and the media or to prepare articles for popular magazines.

In Massachusetts, many of these actions have been taken. The DFW consulted with the state highway department to locate moose crossing signs in high traffic areas, biologists have given many public lectures and media interviews on bears, stressing the importance of removing food sources (e.g., birdfeeders) when bears are active. I&E staff distributed press releases in spring and late summer alerting the media to the threat of moose activity and the emergence of bears from winter dens. Other states have conducted similar measures and have gone even further, using I&E to increase public awareness of large mammal issues (Organ and Ellingwood 2000). These measures are intuitively appealing and do help to raise awareness in the citizens they reach.

However, it is doubtful that actions like backyard birdfeeding in bear country or speeding on roads in moose country will be substantially reduced by any I&E campaign.

Are We Doomed to Repeat the Deer Experience?

Current experience shows that moose and bear populations can not only persist in highly developed areas but increase. No more research is necessary to establish that fact. Many deer population control attempts did not begin until deer numbers had far exceeded tolerable levels. To effectively manage moose and bears, wildlife managers must learn from the deer experience and not rely on a slow, incremental approach to using public hunting to affect a reduction in numbers. This is especially true given the constraints an urban-exurban landscape imposes on hunting. In Massachusetts, a statute prohibits hunting within 500 feet of a building. This 500-foot (152.4 m) restriction zone effectively places slightly more than 18 acres (7.3 ha) of land off-limits to population management around each building. Deer use such areas extensively and may spend nearly all their time in such zones (Kilpatrick and Spohr 2000). Bears may also take up residence in small forested areas near homes, especially soon after den emergence as they exploit birdfeeders, trash and other human-related foods.

Given the declining number of hunters in Massachusetts and the increasing proportion of the landscape that is off-limits to hunting, population management programs should begin before conflicts turn into crises. This will require that wildlife managers have clear and measurable population goals and sound programs in place to monitor populations. Sound monitoring will be critical to convey to the public that hunting is not simply wholesale killing of wildlife but a managed activity with clear and measurable bounds, conducted within a scientific framework. In some cases, as I will suggest, the population goal for a species may be as few as possible. That will be a departure from the past, but it may be the only responsible choice if the alternative is to manage by roadkill. I postulate management scenarios for moose and bears in Massachusetts that demonstrate how public hunting might be used to manage those species.

Example 1—Moose

As stated above, most of the human population of Massachusetts resides in the eastern third of the state, approximately the area east of Interstate 495 (I-

495; Figure 3). Much of this area is developed, but large tracts of wooded area and wetlands are interspersed throughout. Moose have been killed by cars on most major highways; others have been shot by law enforcement or immobilized and relocated from many towns, including Boston. The area is essentially an urban matrix with islands of moose habitat. When moose attempt to move between these islands or colonize one from a more rural area, they often end up on a roadway or in a residential area, unable to safely exit.

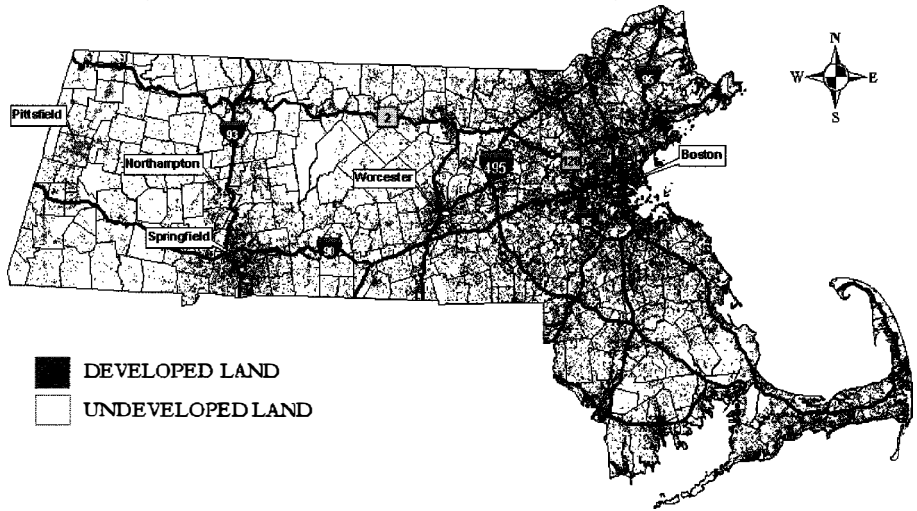


Figure 3. Developed land, undeveloped land and major highways in Massachusetts, 2003. (Massachusetts Geographic Information System 2003)

I suggest that this area of the state have a management goal of as few moose as possible. Such large animals are not compatible on a landscape with more than 1,000 people per square mile and 8-lane highways. The risk of human fatality from a moose-vehicle accident is too great to reasonably allow the animals to attain any sizeable population. Accomplishing this would require a departure from the traditional way of structuring a hunting season. In this specific case, the legislature would have to allow moose hunting. This has happened in Maine, New Hampshire and Vermont since 1980. Recently some legislators in Massachusetts have become interested in the subject, as has the regulatory Fish and Wildlife Board. Thus, there is hope that this example is not moot.

A possible format for moose hunting in eastern Massachusetts would be to run a season concurrent with the deer hunting seasons, beginning in mid-October and ending December 31. Permits would be either-sex, inexpensive and an unlimited number would be available. The goal would be for every hunter who

wanted a permit to have one so that they could take any moose they encountered while deer hunting. The odds of success would be low; although, recent hunter surveys indicated that about 10 percent saw more than one moose while deer hunting (W.A. Woytek, unpublished data). But, few moose would need to be removed each year to hold the population at a minimum.

In central and western Massachusetts (i.e., west of I-495), the matrix is mostly forested (i.e., moose habitat) with scattered urban islands. Major highways parallel the northern and southern borders as well as the 1 north-south interstate (Figure 3). There would likely be public support for maintaining a moose population at higher levels in this rural part of the state, despite the risks they pose. Moose are part of the native fauna, and I suggest a more traditional, limited-entry hunting season in this part of the state. Moose densities are already higher in western Massachusetts than in eastern Massachusetts; thus, the goal may still be zero population growth. However, it would not and should not be zero moose. In the context of hunter numbers and access described above, it would be prudent to start hunting while the number to be removed is as small as possible.

Example 2—Black Bears

Many recent human-bear conflicts in Massachusetts, including increasing numbers of home invasions, have occurred in the urban-rural fringe around cities like Northampton, Pittsfield and Worcester (Figure 3). Most occurred in spring, after den emergence, and during the breeding season. And, many involved resident, adult bears, not just dispersing yearlings. The hunting restriction zones, dense road networks and technique limitations make hunting bears in these areas difficult even though bears exist at relatively high densities.

The use of registered bait sites for bear hunting holds the most potential to increase the bear harvest to a level that will stabilize or even decrease the bear population. Again, this would require legislative action to be implemented. The scope of issues surrounding baiting is too broad to discuss in this paper, but it has merits for this application in terms of safety and efficiency. Baits can be located outside of legal restriction zones, written landowner permission secured, the area posted to inform passersby, and hunters could be required to hunt from treestands, thus further ensuring safety.

Registered baits have been used successfully in Nova Scotia since 1988 (Nette 2001); Maine and New Hampshire also allow baiting for bears. Baiting may be one of the only ways to consistently harvest resident bears in areas around

cities. Even in poor food years in Massachusetts, when hunters can take stands around cornfields or apple orchards, stand hunting has not allowed the harvest of enough bears to stabilize the population. Baiting will not guarantee a larger harvest, but it would likely increase it, especially in those urban fringes where few bears have been taken in the past.

Conclusions

Wildlife managers need to adjust their mindset and adapt their strategies to the successful restoration of large mammals. This success requires active management of populations of these species, not simply conservative skimming. Public education campaigns will be important for these species to retain their value to society; we do not need anymore “hooved rats,” especially 1,000 pounders. However, I&E alone does not constitute a management program.

Moose and black bears can be successfully managed with public hunting in urban or urban fringe areas, provided that managers do not wait so long that large numbers need to be removed to achieve population goals. We must use the example of deer management as a lesson, not a roadmap. The strategies suggested above presume some accepted goals and will be controversial. However, there will never be a time when that is not true; it is only responsible to try to put forward mechanisms to achieve population goals while they are achievable.

The reality we operate in is that most of society does not pay attention to wildlife issues until there is a crisis. Waiting for a crisis to develop before putting forward a plan to deal with large mammal populations seems to be an abdication of our professional obligation. We have seen what happens to wildlife in the crisis-response model time and again in the example of deer. Moose and bears conflict with society in different ways than deer, but those conflicts can be more lethal. We expect civil engineers to fix a leaky dam before it bursts, we must expect no less from ourselves.

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The Role and Services Provided by the U.S. Department of Agriculture-Animal and Plant Health Inspection Service-Wildlife Services Program in the Management of Conflicts Caused by Wildlife in Urban Areas

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Background

Biologist and nonbiologist alike understand that several wildlife species and wildlife habitats are negatively impacted as urban and suburban development continues to expand into rural areas and other areas rich in natural resources. There also exists an interesting paradox associated with human expansion. While human development in wildlife sensitive areas continues to negatively impact some wildlife species, public debate regarding various wildlife damage management methods continues to limit the means of managing conflicts caused by other wildlife that seems to flourish near human environments. The media and writers of story and film have helped to develop a deeper public environmental consciousness and, especially at times, a strong passion towards the welfare of wildlife. While strong emotional sensitivity towards the positive welfare of some wildlife prevails in the public eye, the adaptability and overabundance of other wildlife species has led to conflicts between wildlife and human interests. Though not surprising, the burden of managing these wildlife conflicts has been on federal and state governments and on a growing segment of private wildlife damage management specialists. Today the public insists that the very agencies responsible for managing wildlife populations to ensure their future abundance, also assume the responsibility of managing the conflicts that may occur between wildlife and humans. The absence of professional wildlife assistance and a failure to readily identify appropriate solutions to wildlife conflicts causes some individuals to conduct actions that are ecologically and biologically damaging. Professional wildlife biologists and technicians, such as those employed by the U.S. Department of Agriculture-Animal and Plant Health Inspection Service-

Wildlife Services (USDA-APHIS-WS) program can prevent such reactions. The Wildlife Services (WS) Program has conducted wildlife damage management in various social settings for many years that includes remote, rural, suburban and urban aspects.

Introduction

This informs readers of the function and legal authority of the WS program, describes the organizational structure and operational modes, and describes the types of assistance provided by WS to the public in managing conflicts caused by wildlife. General information is included about the impacts of wildlife conflicts, WS programs and activities involving the management of damage caused by wildlife.

Legal Authority and the Role of Wildlife Service to Conduct Wildlife Damage Management

Wildlife damage management responsibilities and authorities may reside with different agencies, depending on the location, the species and the type of problem caused by the species. In general, and in terms of wildlife damage management, the U.S. Fish and Wildlife Service has primary responsibility for managing migratory birds and federally listed threatened and endangered species. Whereas, state wildlife management agencies have primary authority for the management of game animals, nonmigratory birds and all other species of wildlife not federally listed as threatened or endangered. The federal government, through the USDA-APHIS-WS, is authorized to assist upon request of state governments, private individuals and other federal agencies to control and prevent damage and disease caused or carried by wildlife (Clay 2002).

The primary statutory authority for the WS program is the act of March 2, 1931, (7 U.S.C. 426, 426a-426c and, as amended, 46 Stat. 1468). The WS program assists in solving many different types of problems created by wildlife. WS field personnel are required to conduct activities in accordance with federal and state laws and regulations, including the federal obligation to conduct its activities in compliance with the National Environmental Policy Act (NEPA). NEPA requires that, “all major Federal actions be evaluated in terms of their

potential significant impacts on humans and the natural environment for the purpose of avoiding or, where possible, minimizing significant adverse impacts” (U. S. Department of Agriculture 1987).

The WS program is a cooperative program, and it conducts activities in cooperation with wildlife management professionals from other federal or state agencies. Though a specific agency often has primary responsibility to address NEPA concerns, sometimes the actual burden to proceed through the process is shared by federal agencies. Management within agencies may agree to assign portions of their programs to collaboratively complete parts of the NEPA process. The specific individuals of each agency who actually conduct activities regarding NEPA may depend on the particular agency conducting the federal action, the potential issues involved and the organizational structure of the agency or programs involved.

Organizational Description of the Wildlife Services Program

The organizational structure of the WS program essentially includes the deputy administrator’s office that oversees an eastern and a western regional office, an operational support staff office and the National Wildlife Research Center (NWRC). Each regional director manages a set of state directors, corresponding to states within their regional geographical area. Currently, 40 state directors manage a field force that may include a combination of state and federal employees comprised of supervisory wildlife biologists as district or assistant district supervisors, of field wildlife biologists or technicians, who are sometimes referred to as wildlife damage management specialists. The NWRC Director manages the research segment of the WS program and oversees nine different field stations located throughout the United States. The WS Pocatello Supply Depot Manager reports to the Idaho State Director and manages the inventory and the distribution of chemical and mechanical materials used in the management of wildlife damage. Through the activities conducted at each organizational level, WS tries to keep pace with the increased requests for assistance from the public, while strengthening program infrastructure. In effect, most of the activities conducted by WS personnel throughout the program are generally associated with two primary categories of operation: research and direct operational field wildlife damage management (Clay 2002).

Modes of Wildlife Services Operation: Research and Operational Field Wildlife Damage Management

Research and Methods Implementation

The WS program expends significant resources each year on research to develop new and to improve old techniques for reducing damage caused by wildlife. WS scientists conduct most of this research at the NWRC headquarters in Fort Collins, Colorado.

The NWRC is an internationally renowned network of facilities and scientists who develop both nonlethal and lethal wildlife damage management methods. As the U.S. population has increased and as the number and nature of problems caused by wildlife has increased, the focus of research conducted by NWRC research scientists has evolved to meet changing demands for effective solutions (Tobin 2002). WS, NWRC and the nine field stations throughout the United States are the only federal facilities, as well as the world's only research centers, devoted entirely to the development of methods for wildlife damage management. The enhanced development of many nonlethal methods used by wildlife damage management professionals today in federal and state natural resource agencies have stemmed from research conducted at the NWRC. Further, the NWRC continues to refine techniques often used by private wildlife damage management professionals in urban and suburban settings. NWRC scientists design and test environmentally safe and cost-effective methods of reducing wildlife-human conflicts to help improve wildlife damage management technology. Activities of NWRC are frequently conducted in collaboration with universities and other research entities, other agencies, private industry and WS field specialists in order to test new or improved wildlife damage management methods under field conditions.

Operational Field Wildlife Damage Management Activities

WS assists through operational field activities that may include various forms of information transfer or direct assistance to individual stakeholders, public institutions or other agencies that request help in managing conflicts caused by wildlife. In direct response to cooperator requests for assistance regarding wildlife conflicts, field personnel initially examine circumstances that may include these aspects: the damage or conflict to the associated resource; the ecology and other environmental factors associated with the wildlife thought to be involved;

local, state and federal laws and regulations regarding the wildlife causing the conflict; and the sociology of the local human environment. WS personnel then either convey or apply various methods or strategies of wildlife damage management to alleviate conflicts. Many of these methods or strategies incorporate the advances and developments established by NWRC or collaborative developments with other groups, agencies, foundations or educational facilities. When conducting either technical assistance or direct wildlife damage management, field personnel try to help the public understand the nature of wildlife damage conflicts and the proposed methods or strategies intended to alleviate them.

Most WS personnel are responsible for handling the management of damage or other conflicts caused by wildlife in both metropolitan areas and rural areas. In either urban or rural environments, the WS program assists in alleviating damage or conflicts caused by wildlife, to protect a variety of resources primarily grouped into four general categories:

Agriculture and livestock production. This category includes the protection of grain, sunflowers, vegetables, fruit, nuts, commercial forest resources and other resources involving aquaculture, such as cultivated trout, catfish, bait fish, marine shellfish and other water related resources.

Natural resources. This category includes the protection of wildlife that is threatened or endangered, wildlife habitats, rangelands and other natural resources.

Urban and industrial property. This category includes the protection of property, private lands, public buildings, airports, golf courses and industrial facilities.

Public health and safety. This category includes the protection of airports, aircraft and human health when threatened by the presence or activity of wildlife or wildlife-borne diseases (Clay 2002).

Factors Affecting the Type of Assistance Provided

Like many wildlife managers who address conflicts between wildlife and people, WS personnel must consider the needs of those directly affected by wildlife and a range of environmental, sociocultural, economic and legal factors. When initially analyzing a conflict and developing various strategies of wildlife damage management, WS personnel are required to be aware of and abide by

all laws and regulations that may effect the options available to manage a particular problem. Regulatory aspects that affect options of wildlife damage management may include, for instance, the Federal Migratory Bird Treaty Act (MBTA)—a formal treaty with Canada and Mexico to assist in the conservation of migratory birds—or local regulations regarding the discharge of firearms. Other regulatory aspects may include wildlife game laws, or local regulations affecting the use of specific wildlife damage management devices or other materials, such as capture devices, immobilization drugs, euthanasia drugs or pesticides.

Essentially, the WS program uses two methods, technical and direct wildlife damage management assistance, to help the public to alleviate damage caused by wildlife.

Technical Assistance

A WS representative has the responsibility to determine if a wildlife conflict situation can be handled by the cooperator following receipt of technical assistance, or if there is the need to suggest that direct wildlife damage management be conducted by a wildlife damage management professional. In the absence of direct assistance by a professional, technical assistance alone is provided only when it is feasible for individuals to solve their own problems.

Technical assistance involves providing advice, recommendations, information, demonstrations or materials for cooperator or public use in managing wildlife conflicts. WS provides advice to individuals, groups and other state and federal entities regarding the current legal and effective wildlife damage management techniques for alleviating damage caused by wildlife. When providing technical assistance, WS employees help to identify the responsible wildlife species and determine the extent of the damage. WS personnel may provide recommendations concerning habitat modification, cultural practices, behavior modification of the troublesome wildlife species or ways to reduce specific local wildlife populations to manage the amount of damage they cause. Hence, WS personnel may suggest lethal or nonlethal techniques to resolve wildlife damage problems. These suggestions take into consideration environmental factors and relevant laws and regulations. WS personnel may sometimes provide a recommendation that regulatory agencies issue permits to allow resource owners to deal with wildlife problems.

Biologists or specialists covering vast areas and many metropolitan locations may individually handle thousands of phone and personal consultations

each year. In urban areas these wildlife conflict consultations often include damage caused by raccoons (*Procyon lotor*), skunks (*Mephitis mephitis*), opossums (*Didelphis virginiana*), various birds, snakes and other wildlife species. Wildlife damage management information is conveyed to cooperators through various means that may include telephone consultations, exhibits, written letters, preprinted literature, personal consultations, public service announcements or group presentations.

Information leaflets include subjects, such as a description of the animal's biology, typical damage, suggested management methods and sources of wildlife damage management supplies. WS personnel also provide educational programs to various schools and civic groups regarding wildlife damage management. Sometimes, however, technical assistance alone may not be adequate to solve a particular wildlife conflict.

Direct Assistance

Frequently, there are problems caused by wildlife species that may be too complex or difficult for any one individual, group or agency to solve. A common example is when dealing with thousands of birds roosting in an urban neighborhood. This is usually beyond the capabilities of most individuals. WS field personnel can be available to help those who are experiencing the problem. Direct assistance is usually provided when the resource owner's efforts have proven ineffective and technical assistance alone is inadequate. WS personnel conduct direct control activities when the complexity of the wildlife damage problem requires professional expertise, the use of specialized tools, permits, or other specific wildlife damage management actions. WS personnel consider practical methods for resolving wildlife damage problems and take actions by implementing the most strategically appropriate measures. Whether or not a particular action is appropriate or practical depends on a variety of factors, including the species causing damage, its geographic location, the type of damage and—as mentioned before—the consideration of various laws and regulations.

Often, the most effective strategy to resolve wildlife damage problems is an integrated wildlife damage management approach, which is a combination of several practical methods or techniques of wildlife damage management applied in a systematic manner to alleviate a conflict. The integrated approach incorporates a combination of cultural practices, habitat modification, animal behavior management or local population reduction. The selection of control methods and development of application strategies takes into consideration the

responsible species, the magnitude of the loss and the likelihood of continued damage. In addition, WS personnel consider potential negative impacts to nontarget species, local environmental relationships, social and legal aspects, and relative costs of control options.

Direct operational field assistance is provided only upon request and with a signed cooperative agreement between a WS representative and the entity requesting assistance. Since WS is a cooperative agency, most WS field activities are funded cooperatively by various federal, state or local agencies, industry or private associations, or individuals who request wildlife damage management assistance.

Wildlife damage management in urban areas generally includes but is not limited to controlling damage or nuisance situations caused by raccoons, squirrels (*Sciuridae* spp.), commensal rodents (*Rattus* spp.), skunks, opossums, armadillos (*Dasypus novemcinctus*), various bird species or bats (*Chiroptera* spp.). Some other species may include coyotes (*Canis latrans*), foxes (*Vulpes* spp.), beavers (*Castor canadensis*), pocket gophers (*Cratogeomys* spp.), rabbits (*Oryctolagus* spp.), other hares or snakes. Specific migratory birds, such as Canada geese (*Branta canadensis*), European starlings (*Sturiius vulgaris*) and blackbirds (*Icteridae* spp.) are also increasingly causing nuisance and property damage in urban areas.

In addition to biological knowledge, WS personnel are required to obtain and maintain an expertise regarding the safe use and handling of capture equipment and other devices, tools, pesticides and drugs used to conduct wildlife damage management activities. They are also required to develop an effective collaborative working relationship with various types of other governmental agencies and organizations to help facilitate assistance to the public.

Interagency and Other Cooperative Activities

The activities and accomplishments of the WS program are the result of the cooperative relationship the program has with the public. In conducting its activities, WS collaborates with a variety of entities, which include many state wildlife agencies; state, county and local health departments; the U.S. Fish and Wildlife Service; U.S. Environmental Protection Agency; U.S. Food and Drug Administration; private businesses; and other federal, state and local agencies. The WS program conducts many educational activities, including student intern

programs in collaboration with universities throughout the United States. In addition, input from the U.S. Department of Agriculture Secretary's National Wildlife Services Advisory Committee (NWSAC), provides guidance from diverse stakeholders, representing agricultural, general wildlife management, animal welfare, academia, public health, public safety and the pest control industry.

Impacts of Wildlife Damage or Conflicts and Examples of Wildlife Services Activities

WS works in every state to prevent wildlife damage to property, roads, bridges, aircraft and other important human made resources. Each year, wildlife costs property owners millions of dollars in damage, underscoring the need for responsible wildlife damage management. WS protects homes, lawn, landscaping, golf courses, parks, pets, equipment, machinery, industrial facilities and other property against wildlife damage. In fiscal year (FY) 2000, WS conducted more than 26,200 technical assistant projects to reduce wildlife damage in urban, suburban and rural locations as well as at airports across the country. In FY 2001, WS spent more than \$8 million to protect property from wildlife damage. Wildlife damage to property can be relatively minor, or it may result in significant economic loss and inconvenience. In an effort to gain entry into homes and other properties, wildlife can damage foundations, structures and electrical wiring.

The excrement from roosting birds or bats is not only foul, but it can also corrode machinery, car paint, create a slipping hazard on sidewalks or other surfaces and can negatively affect human health. Wildlife, such as geese and deer, can destroy golf course greens, fruiting plants, lawns and other landscaped areas. In 1999, southern California golf courses reported nearly \$200,000 in damage due to American coots (*Fulica americana*) grazing and defecating on the greens. In addition to causing damage, overabundant wildlife populations can also be quite a nuisance. The noise and excrement from a roost of vultures or crows can be so severe that backyard swing sets, grills and lawn furniture become useless.

Roads, bridges, airport runways, dams, water drainage systems and utilities are also vulnerable to wildlife damage. WS is frequently called upon to remove wildlife that threaten vital urban and rural infrastructure. Aquatic and

burrowing animals, such as beavers, marmots/ground hogs (*Marmota* spp.), gophers, ground squirrels and armadillos often weaken foundations and accelerate erosional damage, causing structures to crack or even collapse. Birds and other wildlife are also frequently responsible for electrical power outages that can result in thousands of dollars in damage and lost revenue. For example, brown tree snakes (*Bioga irregularis*) in Guam regularly caused electrical shortages and power outages that resulted in more than \$1 million in damage until WS began a successful damage management program.

Beaver are one of the most destructive wildlife species, causing millions of dollars in damage to roads, bridges, dikes, dams, sewers, water treatment facilities and landscape plants. In Mississippi and North Carolina, the problem is so severe the WS conducts statewide beaver damage management programs that received major funding from state agencies. In fiscal year 2001, WS prevented an estimated \$27.5 million in beaver damage.

As some wildlife populations have increased in the last decade, so have the number of wildlife collisions with airplanes, trains and automobiles. These high-speed or midair collisions can be deadly and result in serious damage. WS plays a significant role in helping to prevent birds, deer, coyotes, and other wildlife from causing such accidents. Collisions, however, are not the only threat that wildlife can pose to transportation. Rats, mice and other rodents can also chew through engine electrical wiring, creating potentially dangerous consequences. Wildlife can pose a serious threat at airports across the United States. While large mammals are responsible for some collisions, the vast majority of wildlife strikes are caused by birds. WS estimates that, in total, wildlife collisions cost civil aviation in the United States more than \$300 million annually. Through a balanced effort involving research and wildlife management, WS is reducing the incidence of wildlife-caused damage to aviation. WS is recognized internationally for its scientific expertise in reducing wildlife hazards at airports and military bases throughout the United States. In FY 2001, WS efforts to protect air passengers and aircraft had a significant impact. Of the WS projects in which results could be measured, more than half reduced wildlife hazards by an estimated 70 percent.

Conclusion

The WS program recognizes that wildlife is an important resource greatly valued by the public. Since wildlife is becoming more recognized as a

dynamic and mobile resource that can damage various other resources, such as private and industrial properties, agricultural resources, human health and safety, and natural resources, the need for effective and environmentally safe wildlife damage management is rising dramatically. However, public scrutiny and disagreement regarding wildlife damage management methods also seems to be increasing. The WS program, under legal authority and through scientific research, strives to develop and use wildlife damage management strategies that are biologically sound, environmentally safe and socially acceptable. The aim of the program is to reduce damage caused by wildlife to the lowest possible levels while at the same time conserving wildlife. In urban and suburban areas, WS program personnel provide both technical and direct assistance to property owners, industrial producers, health and safety officials, and natural resource managers, who are trying to protect property, the health and the safety of humans and animals from damage caused by wildlife.

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High Profile Urban Wildlife Conflicts: Powder Keg or Opportunity?

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Through urbanization, human encroachment on natural areas continues and interactions with resident wildlife follows. When predators attack children or invade a metropolitan area, the agency with wildlife management responsibilities is plunged into the spotlight. These serious events can quickly become high profile news stories. The Arizona Game and Fish Department (AGFD) has worked with other state agencies, federal agencies and municipal governments, as well as nongovernmental organizations, community groups and the media, to obtain positive outcomes from such critical incidents. Not surprisingly, cooperation and education are essential in reaching this goal.

Agencies that deal with urban wildlife-human interactions should be familiar with roles and responsibilities of other entities that might be involved in resolving these conflicts or have a role in dissemination of information. Key personnel, ideally, should be comfortable with their relationship with these other groups (e.g. U. S. Department of Agriculture-Wildlife Services, U. S. Fish and Wildlife Service, U. S. Department of Health Services, Rabies and Animal Control, police and fire departments, television and newspapers, rehabilitation groups, municipal administrations and homeowners associations). Awareness should include delineations of the role each federal, state, city, county, specific organization and media group plays in addressing wildlife-related issues.

Through experience, AGFD has learned that proactive preparation, community support and collaboration, media involvement, and open, consistent communication are key for positive outcomes of such high profile events.

The Incidents

Coyote—1994

In 1994, a coyote bit a child in an apartment complex in Scottsdale, Arizona. When contacted, AGFD emphasized the rarity of the event. We began to examine the event to determine the potential of future threats. Less than 24

hours later, another bite occurred in the same complex. While we were attempting to determine a cause for these rare events and plan a response, the situation began to slip out of control.

The local police department combed the area with weapons drawn. Officers twice shot at coyotes in the neighborhood, missing both times. This of course, caught the media's attention and their helicopter patrolled the neighborhood. This uncoordinated attention hindered AGFD efforts to control the situation while a solution was being developed. We consulted with U.S. Department of Agriculture-Wildlife Services and decided a course of action. U.S. Department of Agriculture-Wildlife Services destroyed the two coyotes known to inhabit the immediate area within 48 hours of the first bite. Without adequate feedback from AGFD, the media presented sensational stories. Public outcry against killing the coyotes was intense.

The trigger of this conflict was coyote familiarity with humans due to feeding. A number of residents in the area knew of pups in a local den site, and humans had commonly visited the den site. The cause of the attacks was a classic example of why human-wildlife conflicts occur. AGFD explained to the media and the public why destroying the animals was the responsible option. The necessity of testing for rabies and the dangers of releasing coyotes so comfortable around humans were two reasons included in discussions. Our later analysis showed that public opinion, fueled by media coverage and misconceptions about rabies testing and the relocation option, resulted in strong opposition to the action taken.

Coyote—2000

In 2000, a father carried his 22-month-old son into his Mesa, Arizona home. Twenty feet inside the house, he set the boy down on the floor. The father went into another room and was gone for approximately one minute when the child cried out. A coyote had bitten the boy in the shoulder and was attempting to drag him outside. The father ran the coyote off and the child was not seriously injured. Approximately six hours later, the father shot and killed a coyote as it approached the patio.

AGFD investigation and interviews with local residents revealed three coyote packs in the area, with one pack habitually showing very bold behavior and a predictable travel pattern, which included yards and patios. The same interviews described many in the community regularly feeding that pack. AGFD

approved the lethal removal of the brazen pack by Arizona Department of Wildlife Services.

Concurrent with the search for the targeted pack, AGFD personnel visited 26 of the local residents and told them of the attack, the probable reason and the reasoning behind the plan to destroy that particular group of coyotes. We also discussed normal coyote behavior and how to live with urban wildlife. A follow-up survey of the neighborhood showed support for the action taken and appreciation of the personal attention in disseminating information. The media was quickly given information about the feeding, the three packs, the history of the aggressive pack and the plan for lethal resolution. A television reporter was invited to ride along on the community visits. Local law enforcement was notified and details of the plan and the relative roles were coordinated. With the support of the local community, with education on living with urban wildlife and with the media partnering with AGFD, the general public understood the issues and accepted the action of destroying the offending pack.

Bears—2000

In late 2000, an unprecedented influx of black bears descended on the Phoenix metropolitan area. The Phoenix area generally gets a visit from a bear every two to three years. However, throughout the fall and early winter of 2000, 30 bears were reported, and 19 were captured. An ongoing drought had apparently caused young bears (all captured bears were less than two years old) to come out of the wild lands seeking food and water in the oasis of the Phoenix metropolitan area.

Often the bears were highly visible and their appearance resulted in crowds of curious people. Local police departments aided in crowd control and they sometimes assisted in keeping track of individual bears. Media helicopters frequently had sightings of bears before any other reports were received, and, though helpful in some instances, some false reports occurred. A large amount of time was spent investigating bear reports that turned out to be rocks, road kill, black Labrador retrievers and even a decorative sheet metal lawn sculpture of bears. As individual bears were captured, they were transported to a suitable local rehabilitation center. The media filmed and reported many of these events.

Through media contacts, the public was notified that the malnourished bears were to be fed and released at a later time. Television and newspaper reporters were invited to some of the releases. AGFD filmed the process—from

captures to releases—and used it in a segment of their television series. Overall the “year of the bear” was positive. Education on the relationship between wildlife, habitat, drought, and urbanization was disseminated to the public. Coordination and collaboration with the media, law enforcement and the community was clear.

Preparedness Considerations

To address public concerns and perceptions about wildlife during a high profile urban wildlife conflict, it is important to use the incident as an opportunity. The urban public has limited knowledge of or experience with wildlife. However, the general public has great interest in wildlife. To take advantage of this interest, it is vital to link the reasons for conflicts and the reasons for specific resolution decisions. The importance of timely and accurate information transfer when dealing with wildlife-oriented conflicts cannot be overemphasized.

During a high profile urban wildlife event, there is an opportunity to introduce accurate wildlife management information. This instructive process assists the concerned public by educating and instilling appreciation and respect for wildlife. The information must be aggressively communicated to the public to maximize its affect on future public responses to urban wildlife and conflict management.

Major collaborators in critical urban wildlife incidents should include: law enforcement (state, county, city), animal control (wildlife services, local wildlife control operators), media and community personnel. Two general themes should be considered when preparing these players for handling wildlife conflicts: communication-education and partnerships-cooperation. These themes are closely related and there is often overlap when to address my both proactively and in response to a specific event.

Communication-Education

Law enforcement.

- Collaborate to train officers to help educate the public when on the scene or when taking calls.
- Instruct on the relatively minor level of threat to humans and other related information.
- Develop and update contact lists.

- Determine roles in a high profile wildlife event, including reporting sightings, maintaining crowd control and, upon request, tracking individual animals.

Animal control organizations.

- Develop a contingency plan mutually, and maintain close contact with federal, county, city and private wildlife control entities.
- Collaborate for quick (but not hasty) evaluations that lead to responsible decisions.

Media.

- Disseminate consistent information on a regular basis and maintain contact.
- Publicize factual messages by developing concise, informational packets for media.
- Detail the options and describe the responsible choice.

Public-community organizations.

- Be available.
- Maintain visibility to city councils, homeowners associations and neighborhoods.
- Identify key players as contacts.
- Keep the public abreast of options and activities.

Partnerships-Cooperation

Law enforcement.

- Emphasize communication and agree on details of coordination, roles and responsibilities.
- Schedule training and collaborate on animal searches.

Animal control organizations.

- Develop agreements with agencies and have them in place (memoranda of understanding, etc.).
- Establish rapport with local licensed wildlife control operators for assistance on request.

Media.

- Contact media reporters frequently.
- Volunteer wildlife information and develop stories between crises.
- Deal with customary beat reporters who are already familiar with topics and issues.

- Minimize the number of agency spokespersons for consistency.
- Coordinate activities during prolonged events (helicopter use, on-site reporting, etc.).

Public-community organizations.

- Maintain personal contact.
- Establish proactive, urban, wildlife, public presentations for communities.
- Emphasize that solutions are developed through consistent community-based actions.
- Advise on agency role and community responsibility.
- Develop relationships with rehabilitation groups and veterinarians to assist with treating and holding wildlife for possible release.

Conclusion

After the 1994 urban coyote incident, the AGFD learned that collaboration with key partners would help maximize the rapid dissemination of factual information describing resolution options and decisions. Comparing the Scottsdale coyote attacks on children in 1994 and 2000 and evaluating the actions taken during the appearance of large numbers of bears in the greater Phoenix metropolitan area in 2000, illustrates how such situations become highly problematic or how they can be managed positively. Early and honest communication, development of key partnerships and ongoing education are important in developing public support for and understanding of wildlife conflict management decisions.

The Infrastructure for Conducting Urban Wildlife Management Is Missing

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Factors That Set the Stage for Urban Wildlife Management

The convergence of three societal events at the end of World War II set the stage for urban wildlife management. First, automobiles became more affordable to returning soldiers who had plenty of money to purchase both a car and a home. Second, Cold War mania was a stimulus for the passage of the Highway Revenue Act of 1956, which created the Highway Trust Fund; the Highway Trust Fund led to the development of the network of super highways through, around and out of the cities. The original political justification for extensive highway construction was to provide city populations a rapid escape mechanism in the event of nuclear attacks. Together, the highways and affordable automobiles (also cheap gas at 10 cents/gallon) provided opportunity for human migration from the self-contained communities within the larger cities to suburban developments several miles from the city core. A third event was the movement of people from the family farm to the city. In North America, the shift from a largely agrarian to urban society began around 1945, at the end of World War II, and has continued without cessation to the present time. Today, more than 80 percent of U.S. citizens live in urban areas. These three events led to a phenomenon called *urban sprawl*. Urban sprawl refers to a process where the perimeters of the city are extended outward into the countryside, one development after the next, with little plan as to where the expansion is going and no notion of where it will stop (Wright and Nebel 2002). This phenomenon set the stage for a human-wildlife interface that had not existed before, and it reinforced a separation between people and wildlife.

The Separation of People and Wildlife

One might conclude, if people moved to the city fringe, they would take advantage of the opportunity to reconnect with nature and wild things. However,

the opposite reaction occurred which was to simplify and destabilize their surroundings, i.e., bring the structure of the city ecosystem to the country. This was done by removing and replacing natural vegetation, changing the natural landscape and replacing endemic wildlife with exotic animals. A detailed description of the structural, biotic and socioeconomic features of urbanization was provided by McDonnell and Pickett (1990). Urban structural features consist of dwellings, factories, office buildings, warehouses, roads, pipelines, power lines, railroads, channelized waterways, reservoirs, sewage disposal facilities, dumps, gardens, parks, cemeteries, and airports. Crops, ornamentals, domestic pets, pests and disease organisms are the dominant biotic features of urbanization. Socioeconomic features include human values, wealth, life-styles, resource use and waste. Urban dwellers are usually unaware that by changing the structural and functional components of natural ecosystems they are creating alternative habitats for a wide array of animals (invertebrates and vertebrates), which are quick to take advantage of the habitats provided. This results in many unique human-wildlife interactions (e.g., coyotes in city parks). “There are two spiritual dangers in not owning a farm. One is the danger of supposing that breakfast comes from a grocery store, and the other that heat comes from the furnace” (Leopold 1949).

The quote by Aldo Leopold is a succinct evaluation of how an urbanized society runs the risk of using simplistic explanations for complex phenomena. Decades and generations of human isolation from the natural world through urbanization has produced, in developed countries, a society that lacks a connection to the natural world and wildlife and an understanding of interrelationships. For example, few people in contemporary society appreciate what their last breakfast cost wildlife in terms of food production, transportation, packaging and distribution. Leopold’s quote notes a second disconnect between society and nature, in terms of understanding the costs to the environment and wildlife to provide the energy required for home heating, e.g., surface coal mining.

Observations about the Human-Wildlife Interface in Contemporary Urban Societies

The Need for Wildlife Management in Urban Areas

There is strong evidence justifying the need for wildlife management in urban areas. This need is based on decades of population shifts from rural to urban

areas, a lack of wildlife management paradigms focused on urban people and wildlife, animal damage control issues, a growing body of literature (professional and popular) about wildlife in urban areas, career opportunities, and generations of human isolation from their natural environments. The majority of residents in developed countries no longer live in the country. The expansion of urban areas into formerly natural environments causes human-wildlife interactions that are unique because these interactions are met with a variety of human emotions, explanations and reactions, mostly conceived in an intellectual and experiential vacuum. Wildlife biologists employed by state and federal agencies and the land grant universities have been caught off guard. The traditional wildlife management curricula produces traditional wildlife biologists who focus their expertise on game, nongame and threatened or endangered species in nonurban habitats.

The degree to which contemporary wildlife curricula, nationally, are training urban wildlife biologists was, at best, a token effort (Adams et al. 1987). The criteria that defined the training and tasks expected of an urban wildlife biologist emphasized the human dimensions of wildlife management (Tylka et al. 1987). The complex nature of conducting field research in urban settings was explained by VanDruff et al. (1996). Again, the emphasis was on the considerations of habitat structure in urban environments, compared to rural environments, and the problems resulting from frequent contact with humans during the research process. The results of a national study on the degree to which land grant universities and state agencies are addressing urban wildlife management now is presented later in this paper. The number of peer reviewed manuscripts on urban wildlife management research in the two major journals of The Wildlife Society (TWS), i.e., *The Journal of Wildlife Management (JWM)* and *The Wildlife Society Bulletin (WSB)*, has grown steadily since 1997. One entire issue, 58 articles, of the WSB (1997) was dedicated to research on white-tailed deer overabundance in urban communities. Newspaper articles about wildlife in urban areas are becoming more frequent, such as coyotes in city parks, cougars in people's back yards and urban deer herds. Some state agencies are now advertising available positions in various aspects of urban wildlife management, e.g., wildlife damage biologist, urban wildlife biologist and urban outreach supervisor. Finally, urban residents have lost the skills to identify wildlife species, do not know why particular species of wildlife occur in their backyards or how to deal with a problem species, and do not understand interrelationships

between people and wildlife. Several misconceptions about urban wildlife exist, including all snakes are poisonous, abandoned baby deer need human care, missing pet cats and puppies have strayed off or have been stolen, feeding wildlife is a human obligation and predatory animals do not exist in urban habitats.

Urban human populations are in need of education programs about the wildlife around them. Several indicators justify the need for educational programs that inform urbanites about the wildlife around them. One indicator was found in an examination of what formal public school curricula offer students about how the world works. Other indicators were found in observations of how people react to wildlife in their backyard. Furthermore, an inventory of the types of programs by state, federal and private agencies and how they are delivered needs to be considered. Finally, an analysis of urban high school students' knowledge of wildlife provided guidance in educational program development (Adams et al. 1987).

One might expect that the most logical place in the public school curricula to learn something about urban environments, plants and animals is the biology class. Adams and Greene (1990) suggested an alternative biology curriculum built around a conceptual framework that provided both teachers and students with an ecological approach to biology education. Many of the changes they suggested would convert the traditional content of biology courses into material that promotes student awareness, knowledge and actions concerning societal (urbanite implied) impacts on biological resources. Their suggested revisions would have made the biology curriculum, in part, a course in survival training, encouragement toward life-long learning and a connection between people and wild things. In the same issue, Adams (1990) provided examples of classroom activities involving urban wildlife, e.g., tracking radio-collared fox squirrels around their urban habitat.

Human reactions to wildlife in their backyard represent a broad spectrum of emotions that are based on previous information (formal and folklore) and experience, regarding what the animal is and what it is doing. Kellert (1980) tried to categorize this spectrum of emotions and reactions into a static taxonomy that ignored the dynamics of human and wildlife encounters in urban environments. For example, a person's emotional response and reactions to a snake and a swallow; the latter, a seemingly helpless and aggressive animal, will be different. Examples of these differences provided some guidance to the types educational programs that are needed. One of the most basic lessons urbanites need about

the wildlife around them is that, if a wild animal does not run away or establish a safe escape distance, there is something wrong. One can assume that physical barriers to the animal's normal escape routes do not exist. However, humans may apply an anthropomorphic interpretation of the animal's behavior, e.g., the animal wants to be my friend or needs my help. Cases in point include feeding wildlife, rescuing abandoned baby deer or sick animals, and allowing the nearly exponential proliferation of some charismatic species (e.g., deer and waterfowl). Schmidt (1997) suggested that human reactions to wild animals can be based on their perceptions of whether the animal has "crossed the line." In other words, has the human-wildlife encounter resulted in the existence, potential or fear of damage?

Since the mid 1980s, there has been a proliferation of educational programs about urban wildlife and habitats by state and federal agencies and private organizations. Nearly all of the programs were designed for nonformal delivery systems; i.e., a method of information transfer that can occur in any setting to individuals for whom participation is a personal choice (Adams and Eudy 1990). Some programs were designed to address the educational needs of teachers and their students, including Project WILD, Aquatic WILD, Project WET and Project Learning Tree. These programs were offered as an activity-based learning system to supplement the state mandated curricula. Community based programs on urban wildlife and their habitats include Master Naturalist, Master Gardner, Backyard Wildlife and Watchable Wildlife. The latter program led to an annual event called Eagle Days in several communities throughout Missouri and the Gulf Coast Birding Trail in Texas. Nearly all of the programs that are now available rely on volunteer facilitators and participants to conduct training workshops. The long-term success of these programs is based on a steady recruitment and retention of qualified volunteers who have high achievement and altruistic values, identify with program goals, and who have a high interest in and concern for the environment (Greene and Adams 1992).

The findings of Adams et al. (1987) discouraged any assumptions of an enlightened public concerning wildlife, particularly high school students. The students could not correctly identify many common urban wildlife species (e.g., opossum versus rat), the relative numbers of selected mammals within Harris County, Texas (e.g., raccoons are rare but cougars are abundant), the eating habits of 8 of 16 mammals or the effect of the presence of people on the relative abundance of mammals. The students' lack of knowledge might be attributed to

a lack of contact with wildlife given their life-time residency in an urbanized environment and related life style. One needs to consider how urban residents learn about wildlife in order to understand some of the study results. The majority of urban residents learn about wildlife through television programs in the comfort of their homes, isolated from the natural world. Why wouldn't young people consider cougars nonpredatory and abundant in urban settings when they see on television a former Secretary of the U.S. Department of the Interior sitting beside an unrestrained adult cougar? Price (1999) provided several other examples of how urbanites learn about wildlife in the utilitarian worlds of advertising, the fashion industry and shopping malls. Adams et al. (1987:185) suggested that urban wildlife education programs focus on the basic principles of cycles, interrelationships and diversity exemplified with human and wildlife interactions and include wildlife-related activities using species common to the urban environment.

Human encounters with wildlife in urban environments can lead to curious, if not disastrous, outcomes. Human and wildlife encounters in urban areas are increasing as a newsworthy event in the print and electronic media. Particular attention has been given to human encounters with predatory mammals, e.g., coyotes, cougars and bears, the presence of a coyote in New York City's Central Park, cougars in the backyards of El Paso, Texas, and coyote, cougar and bear attacks on humans in several locations in the United States. The particular importance of this observation was the realization that urban residents lack the tools required to make informed decisions about wildlife encounters, and they lack the knowledge needed to interpret the events. The best people to interview concerning human response to encountered wildlife, specifically knowledge and attitudes about wildlife, are wildlife rehabbers and damage control specialists. These individuals, in most states, are the only ones the public can turn to for answers to their questions about the wildlife around them.

Urban humans need to be shown how to reconnect with the natural world around them. The predominant method used by urbanites to reconnect with the natural world is to construct environments, e.g., wildscaping and bird feeders. Nearly all of the constructed environments lead to a paradox in urban wildlife management. For example, programs like Backyard Wildlife and Wildscapes are designed to invite wildlife, and, once the habitats are provided, the animals will come. It is a fundamental ecological principle that plant habitats select or preclude animal species. The paradox becomes evident when too many of a particular

species are invited because they become the object for the alternative form of management that is designed to reduce their numbers, e.g., the deer and geese problems in many cities across North America. An additional dilemma is caused by supplemental feeding of wildlife and the provision of alternative housing. Urbanites spend billions of dollars annually to purchase the feed and accouterments to facilitate the feeding process, e.g., bird feeders (U.S. Department of the Interior 1996). However, the feeders mainly attract seed-eating birds and unwanted mammals (raccoons, rodents and reptiles) followed by predatory animals (cats, snakes, owls and hawks). It is reasonable that, if any animal is provided with a continuous, reliable and high calorie food source, the biotic potential will increase, leading to higher than normal survival rates of the young. High recruitment rates lead to population increases that exceed the carrying capacity of a natural environment.

An alternative for urbanites to reconnect with the natural world is to utilize the benefits provided in urban open areas, e.g., parks, vacant lots, cemeteries, greenways, abandoned railroad tracks, lakes, streams and rivers. The structure of urban habitats already provides plenty of food, water and shelter for many wildlife species. In fact, several animal species have been brought back from virtual extinction, e.g., peregrine falcon and San Joaquin kit fox, because of the resources provided in urban environments. Many urban open spaces, e.g., parks and cemeteries, provide excellent birding opportunities during the height of migration. Such places offer urban birders the opportunity to see a great variety of birds without ever leaving the city limits.

The numbers of many species of urban wildlife are increasing to nuisance levels. There are several species of animals that have adjusted so well to the urban life style that they have “crossed the line” (Schmidt 1997) to become nuisance species. These are the animals that usually require the assistance of animal damage control (ADC) experts attached to the U.S. Department of Agriculture-Animal Plant and Health Inspection Service’s Wildlife Damage Management Services (WDMS) or of private companies who are members of the National Wildlife Control Organizations (NWCOS). The types of species that provoke large numbers of calls to these agencies and organizations will vary regionally, e.g., alligators and nutria in the Southeast, bear and cougar in the West, polar bears in extreme Northwest, and cattle egrets in the southcentral United States. However, there are what might be called typical nuisance species in any urban setting. These can be identified by accessing the call records of the state

WDMS. ADC personnel employed or contracted by WDMSs fill out a form, part of which identifies the problem species. These data provide, at best, trends or generalizations of those species that constitute the greatest public interest or concern in urban areas. One year of information generated by the Texas WDMS revealed the species list provided in table 1 (D. M. Ruffino, personal communication 2002).

Table 1. Species requiring help, information or both from people residing primarily in urban areas, from October 1, 2000 to September 30, 2001.

Number of calls	Species
50–99	blackbirds (mixed), cattle egrets, common grackles, great-tailed grackles, vultures (mixed), house sparrows, moles, nutria
100–199	bats, feral cats, feral hogs, pocket gophers, black-tailed prairie dogs
200–299	feral pidgeon, armadillo, snakes
300–399	beaver
400–499	fox squirrel, opossum
500 or more	raccoon, roof rat, striped skunk, coyote

Some differences in the common nuisance species should be expected given the difference in types of resources (food, water, shelter) provided by urban communities, patterns of urban sprawl into natural habitats, age of community and patterns of land fragmentation during development. An investigation of the common nuisance species within the urban areas of each state would also provide some interesting comparisons. In addition, the reason a nuisance species is classified so provides some interesting insights to how these species have adapted to the urban environments. A nuisance species could be defined as any which causes negative impacts on human health or economics. For example, food for a pet dog or cat is sumptuous fare for raccoons and opossums. Small dogs and cats provide an easy meal for coyotes. Congregations of thousands of birds of any kind results in fecal discharges that saturate and cover trees and buildings and that pollute water impoundments. Raccoons, opossums, squirrels, skunks, armadillos, foxes and many other species find adequate dens for living and raising their young in the homes of urban residents. In short, if there is a resource that can be exploited, urban wildlife will find and utilize it. Often, their exploitive behavior is aided by humans who, directly or indirectly, invite wildlife into their backyards or homes.

Urban wildlife management will probably become the dominant focus of wildlife professionals. There is great satisfaction in believing that one’s efforts are on the cutting edge or present the new paradigm for action. This paper was

written too late, given the chain of events that has led to the reasons for its development. The issues addressed represent a wildlife management need now and certainly into the future. If there was ever a time to conduct urban deer management, it is now. Nearly every urban community, as defined here, has an overabundant deer problem. There is probably a greater need for wildlife biologists with state and federal agencies to apply their management skills to urban rather than rural deer herds. Interestingly, some developers of residential areas have marketed the concept of close proximity of deer to prospective customers. It may be a unique and attractive advertising campaign, but the wildlife management and conflict resolution problems that ensue are formidable. On the other hand, management of urban wildlife may focus on species restoration of threatened or endangered species.

Urbanization and the encroachment of humanity into areas considered to be the native habitats of wildlife will continue. Every state wildlife agency has been given the legislative mandate to manage ALL of the state's wildlife resources without the caveat of whether the wildlife reside in the city or country. Furthermore, traditional wildlife management strategies applied in rural areas are not completely adequate in urban areas; people become an important addition in the management paradigm (VanDruff 1996).

The Infrastructure for Conducting Urban Wildlife Management Is Missing

In 1999 the Urban Wildlife Working Group of The Wildlife Society conducted a national survey of state departments of natural resources and land grant universities that offered at least a Bachelor's degree in wildlife science. The survey was conducted by faculty and students associated with the Human Dimensions in Wildlife Management Laboratory in the Department of Wildlife and Fisheries Sciences at Texas A&M University in College Station, Texas. The e-mail survey was designed to determine how well all of the land grant universities and state wildlife agencies were prepared to address urban wildlife management issues. Survey questions were designed to determine the status of urban wildlife management in each respondent's state related to the:

1. relevant urban wildlife management issues
2. number of urban wildlife biologists
3. qualifications and tasks that differentiate urban from other wildlife biologists

4. number of wildlife biologists
5. degree of respondent (university or state agency) responsibility for urban wildlife management
6. method that urban wildlife management issues are addressed
7. number of universities and colleges that offer at least a Bachelor's of science degree in wildlife sciences or courses in urban wildlife management
8. future need for urban wildlife biologists.

Response rates were 80 percent and 94 percent from universities (n = 37) and state wildlife agencies (n = 46), respectively. Survey results can be considered as an accurate portrayal of national trends.

Only one university respondent reported that there were no urban wildlife management issues relevant to the state. On the remaining questions there was little difference in the response frequencies by university and state agency respondents. For example, 85 percent admitted that urban wildlife was a growing management concern. Ninety percent agreed that urban human populations needed educational programs about the wildlife around them. Only approximately 64.5 percent felt that there was a growing human curiosity about the wildlife in their urban habitats. Yet, between 60 and 83 percent of the respondents agreed that: (1) there was a growing concern about dangerous human and wildlife encounters in urban environments, (2) urban humans needed to be shown how to reconnect with the natural world around them, (3) urban habitats provided plenty of food, water and shelter for many wildlife species and (4) the number of many species of urban wildlife were increasing to nuisance levels. The lower levels of agreement with the above issue statements were always by the university respondents. Finally, approximately 10.5 percent of the respondents agreed that urban wildlife management will probably become the dominant future focus in their states.

Based on the definition given below, respondents reported the employment of 7 and 46 urban wildlife biologists compared to 545 and 5,409 traditional wildlife biologists in their university and agency, respectively.

Forty-four percent of the respondents said there were few to no qualifications that differentiated urban from other wildlife biologists. However, given a list of qualifications provided by Tylka et al. (1987), respondent groups (university versus agency) had different levels of agreement. For example, 65

percent of the university, compared to 29 percent of the agency, respondents felt that a qualification of an urban wildlife biologist should be the ability to evaluate effects of urbanization on habitat. Only 43 percent of the university and 32 percent of the agency respondents identified the need for the qualification of being able to solve wildlife damage problems. Twenty-seven percent of the university and 15 percent of the agency respondents identified the qualification of being able to evaluate public attitudes.

Only 36 percent of the university and 29 percent of the agency respondents said there were few to no tasks that differentiated urban from other wildlife biologists. However, given a list of tasks provided by Tylka et al. (1987), respondent groups (university versus agency) had different levels of agreement. For example, 35 percent of the university, compared to 21 percent of the agency, respondents felt that a task of an urban wildlife biologist should be animal damage control. Only 41 percent of the university and 27 percent of agency respondents identified the need for establishment of urban wildlife habitats. Sixty-two percent of the university and 31 percent of the agency respondents identified the task of conducting research focused on urban wildlife management as important.

Respondents were asked to identify the level of responsibility (all, some, none) their university or agency had for urban wildlife management. None of the university and 54 percent of the agency respondents said all urban wildlife management was their responsibility. Sixty percent of the university and 46 percent of the agency respondents said that they had some responsibility for urban wildlife management. Forty and zero percent of the university and agency respondents, respectively, said urban wildlife management was none of their responsibility.

There are 15 states that have land grant universities, but do not offer even a Bachelor's of science degree in wildlife sciences. Interestingly, university and agency respondent groups were in close agreement concerning the number of universities or colleges in their state that offered a Bachelor's of science degree in wildlife science (67 and 78, respectively), courses in wildlife management (11 each) and courses in urban wildlife management (7 and 6, respectively).

The estimated future need, e.g., next five years, for urban wildlife biologists employed in land grant universities was 20 compared to 170 by agencies. However, less than 25 percent of the respondents expected their needs to be met in the next five years.

This study showed that the infrastructure for urban wildlife management is not well developed within academia or wildlife agencies and agrees with the

findings of Adams et al. (1987:2). The degree to which land grant universities and state agencies were prepared to embrace the challenge of urban wildlife management was less than encouraging. Few of the wildlife professionals within these agencies have been trained to manage wildlife in an urban setting, i.e., qualify as urban wildlife biologists. Few land-grant universities offering at least a Bachelor's of science degree in wildlife sciences offer even one course in urban wildlife management. Overall, study results noted that universities and agencies are:

1. relying on conventional management philosophies and skills to address urban wildlife management issues
2. applying token efforts to enormous if not insurmountable urban wildlife management problems
3. not recognizing urban wildlife management problems as their responsibility
4. somewhat oblivious to present and emerging urban wildlife management problems.

Definitions of Terms

Urban and Rural

For Census 2000, the U.S. Census Bureau classifies *urban* as all territory, population and housing units located within an urbanized area (UA) or an urban cluster (UC). It delineates UA and UC boundaries to encompass densely settled territory, which, respectively, consists of:

- core census block groups or blocks that have a population density of at least 1,000 people per square mile
- surrounding census blocks that have an overall density of at least 500 people per square mile.

The U.S. Census Bureau's classification of *rural* consists of all territory, population and housing units located outside of UAs and UCs. The rural component contains both place and nonplace territory. Geographic entities, such as census tracts, counties, metropolitan areas and the territory outside metropolitan areas, often are split between urban and rural territory, and the population and housing units they contain often are partly classified as urban and partly classified as rural.

Urban wildlife. These are nonsocialized animals, living within urban zones that utilize the resources of urban settings to complete all or part of their life cycles.

Urban wildlife biologist. This is an individual who works primarily in urban, suburban or metropolitan (nonrural) environments and focuses on nondomestic vertebrate and invertebrate species as well as human associations with wildlife.

Urban wildlife management. This is distinguished by urban settings with its humanized environments, anthropic ecosystems and anthropogenic relationships with selected wildlife species (VanDruff et. al. 1996)

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The Private Sector's Involvement in Wildlife Control

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The History of Pest Control

Pest control has been illustrated in Egyptian rock carvings dating 1500 B.C., and the bubonic plague, commonly referred to as the Black Death, ravaged Europe between 1347 and 1350. During this short period, 25 million people (one third of Europe's population at the time) were killed. Thousands of people died each week, dead bodies littered the streets and, in some villages, there were more dead than there were people left alive to bury them. Once a family member had contracted the disease, the entire household often was doomed. Parents abandoned their children, and orphans roamed the streets in search of food. Victims, delirious with pain, often lost their sanity. Life was in total chaos. The plague was a disaster without a parallel, causing dramatic changes in Medieval Europe, creating one particularly dangerous job—the lowly rat catcher.

Rat Catcher, the Vermin Slayer

Imagine if there were a job description in the Middle Ages for the rat catcher, it might have read: “Wear the stench of the sewers and see folks stare at you. Hear them whisper in your wake. There may be filth beneath your fingernails, but be assured your heart is clean and pure. You can handle the derision of others, for yours is a high and noble calling—a rat catcher. Stand with your brothers as the guardians of the city. Your noble deeds are never seen, and your work is never done. Every day, don your candle helms and heavy gloves, and descend into the dark, crawling through sewer, drain and basement in pursuit of your prey. Every day you risk your health and your lives for the good of all, so the people of the cities may live without fear of disease and hunger. The simple folk may mock you because they do not understand. The names they call you don't bear repeating in public. Yet, your work must be done, so do it gladly. When all the knights and foot soldiers go to war, you must remain here and see that nothing evil lurks within our blessed city. Be ever vigilant; let no spy or beast creep into or out of the city until they return. You must stop every rat in the sewers below!

For, if disease or treachery should take this city in our army's absence, then all our victories on the field of battle will be for nothing. Fix a lantern to your helm, and go into the sewers, driving out the rats and other beasts that dwell below. Others will join you in his mighty crusade, and, soon, brave men in other cities will follow your example. Sacrifice your dignity for the good of all. You are mocked and reviled by the people you serve, but you must never forget your calling. Without you, the vermin would eat all stores of food, and the people would starve in the winter. It was your order that first discovered that rats carry disease, and, thanks to our efforts, the great plagues are almost unknown. There are rats in the depths of the sewers who can strip the flesh from a human's arm in ten heartbeats, great rats the size of dogs who would steal children from their cradles. They would eat everyone out of house and home if not for your efforts. Yours is a calling that takes strength, skill and courage. (I'd like to see a knight crawl through half a mile of filth and plunge into a rat's den!) Once you've walked in the dark long enough, the lesser vermin of the sewers will come to know you, and they will fear and respect you. Folks that live in the sun don't understand you. They never will, and they'll never thank you. It's no matter. Time to bid the sun goodbye, for the traps are waiting. Vermin, make ready! The rat catchers cometh for you!"

Modern Wildlife Damage Control

Today, modern pest control is the art, science, technology and business that protects the health and comfort of mankind, and it preserves property from harm and destruction by insects, rodents, birds, weeds, wood-destroying fungi and related pests. The industry is service-oriented and, to a larger measure, acts as an attendant or therapist to the urban environment (Snetsinger 1983).

Within the pest control industry there are several specialized types of pest management that have been developed. For example, some companies perform only termite control, while others specialize in space fumigations. Urban wildlife control is yet another highly specialized form of pest control that concentrates on wildlife pests and is considered its own category—vertebrate control. Services include control of commensal rodents, trapping of larger vertebrate pests and an integrated variety of control, prevention and repairs that are related to wildlife damage and management; we are not trappers.

At the Third Eastern Wildlife Damage Control Conference in 1987, the growing issues of urban wildlife control were just beginning to be addressed:

“Wildlife damage complaints are increasing throughout the United States. Continuing population expansion, spreading urbanization, and increasing wildlife populations are factors in this trend. Damage concerns involve not only agricultural and forestry interests but also urban and suburban residents and the resource managers to whom they turn for help and advice” (Stribling and Holler 1987). Furthermore, “The U.S. Department of Agriculture’s emphasis is on agriculture (crop damage/depredation), not on urban wildlife.” The U.S. Department of Agriculture (USDA) also indicated current funding problems, and increased requirements to update pesticide registrations, along with a decreasing staff—as the USDA’s primary areas of concern” (Fitchner 1987). Finally, “The private sector has been involved in certain aspects of nuisance wildlife control for some time. Examples include commensal rodent control by pest control companies, capture of nuisance fur-bearers by trappers, and repair of structural damage by carpenters. Social trends, such as increased urbanization, increased population of certain wildlife species, and decreased government funding have combined to provide increased opportunity and need for the private sector in wildlife control” (Braband and Clark 1987).

The Critter Control Service

I, a Michigan chimney sweep who was frequently asked to remove animals from chimneys, founded Critter Control, Incorporated (Critter Control) 20 years ago. I found very few individuals or companies that wanted to deal with problem animals, along with a fairly high demand for the services. An industry was born. Critter Control incorporated and began franchising in 1987, and branches have been added at an average rate of almost one per month. Currently, there are over 100 offices in 38 states, employing over 300 people (many of them wildlife biologists) in the field of private animal control.

A Multitude of Interested and Related Parties

Critter Control is at the interface of a large number of interested parties. What follows is just a sample of those parties, with some comments on their limitations in dealing with wildlife damage control:

- Traditional pest control companies deal primarily with insects and some commensal rodents. Most do not have the tools, equipment, time or

knowledge to deal with larger vertebrate pests. Pest bird and animal control requires special skills substantially different from those needed in traditional pest control.

- There are tens of thousands of fur trappers around the country. They do not usually have the licenses, permits and insurances necessary to provide full service animal control to the general public, yet many states require the NWCOs to hold an unrelated trappers permit-license.
- Municipal animal control officers primarily deal with dogs and cats. They do not have the licensing necessary to use pesticides, nor the funding or the equipment needed to handle larger vertebrate pests. And, they are generally available only Monday through Friday, from 9:00 a.m. to 5:00 p.m.
- Government wildlife damage control consists primarily to address agricultural complaints (crop damage and depredation).
- Humane societies and animal shelters are usually staffed with volunteers who are often not fully trained or funded to handle the volume of wildlife conflicts that arise.
- Animal welfare interests espouse idealistic solutions, versus the realistic solutions needed to cost-effectively and humanely deal with the situations encountered on a daily basis.

Wildlife Damage Control Surveys

To better define the subset of society which our company serves, Critter Control has initiated several industry surveys. The results of these surveys will hopefully provide valuable information for maintaining and improving the quality of our service.

The survey results are incorporated into a discussion of attitudes towards wildlife in nuisance situations and how these attitudes affect the control of such problems. These attitudes, many of which are frequently baffling to wildlife professionals, provide the sociological context within which wildlife damage control, and wildlife management in general, must operate.

Survey Results

Hundreds of Critter Control customers were surveyed in 1990 and 1991 on their views and experiences with nuisance wildlife. Most of the survey

respondents were having problems with raccoons, squirrels, skunks, woodchucks and moles. Approximately, 25 percent of the respondents attempted to control the nuisance situation themselves before contacting Critter Control.

A majority of the customers approved of the lethal control of rats, mice, moles, snakes, bats, pigeons and skunks. Most disapproved of the lethal control of deer, geese, woodpeckers, squirrels and raccoons.

Eighty-eight percent of the respondents described the humane treatment of nuisance animals as either “very” or “moderately” important to them. A majority (60.3%) of the respondents lived in suburban situations, while the minority (13.5%) lived in rural areas. The remainder (26.2%) were city, or urban, residents.

In the 1990 survey, most of the respondents had contacted Critter Control about raccoons (31.6%) or squirrels (26.8%). The problem animals were more diverse in the 1991 survey, with raccoons (20.5%), skunks (15.5%), woodchucks (14.8%) and moles (11.2%) being the most common. Other species reported in the surveys were birds, mice, opossums, snakes, bats, voles, muskrats, chipmunks, bees, wasps, rats, turtles, domestic cats, gophers and prairie dogs.

Combining both surveys, 24.8 percent of the respondents had attempted to control the nuisance problems on their own before contacting Critter Control. Of these, 26.3 percent attempted to repel the animals, 25.8 percent tried to live-trap, 20.7 percent used poisons and 16.4 percent attempted lethal traps. Based on the 1991 survey, only 16.7 percent tried to exclude the problem animal, a major factor in permanently solving wildlife damage problems.

Thirty-two percent of the 1990 survey respondents were currently using a pest control service in some capacity. Another 22 percent had contracted such services in the past. Most respondents (73.2%) approved of limited pesticide use by professionals. Few (3.6%) disapproved of any pesticide use. Fifty-two percent of the customers indicated they would like to see more natural or biological control methods. A majority of the customers (76.4%) used pesticides (such as insecticides, rodenticides and herbicides) themselves.

Most of our survey respondents approved of the lethal control of rats and mice (95.2%), moles (78.5%), snakes (74.3%), bats (71.2%), pigeons (59.9%) and skunks (56.5%). Most respondents disapproved of the lethal control of deer (69.8%), geese (66.7%), woodpeckers (65.2%), squirrels (58.0%) and raccoons (55.1%). The survey respondents split fairly evenly on approval or disapproval of the lethal control of woodchucks and opossum (52.2% disapproval).

Of the 1991 survey respondents, 44.3 percent stated that humane treatment of the animal (reduction of pain) was “very important” to them, and they would be willing to pay additional costs to insure a humane approach for control. Of the remainder, 43.6 percent described humaneness as “moderately important” (desirable but not worth additional costs), and 12.1 percent listed it as “unimportant” (having little impact on the decision).

When asked to select the preferred options for handling a nuisance complaint, the most commonly selected approaches were euthanasia for sick animals (24.5%), relocation (24.5%), lethal traps (21.3%) and extermination for rodents (18.9%). Few respondents preferred live-trap and euthanize (6.9%) or live-trap and release on-site (3.5%), showing a lack of understanding of the more cost-effective, humane and ecologically responsible wildlife management applications. This further illustrates the need for public education on the part of wildlife control operators.

Management Implications

Humane treatment of the nuisance animals was important to most of the survey respondents. For the purpose of our survey, we defined humaneness as the reduction of pain felt by the animal. Different people, however, tend to have different interpretations of what constitutes humaneness. For example, to many, humaneness means nonlethal.

Responding daily to a wide range of, often, strongly held perspectives on animals is a challenge for the field technician. An approach which pleases one customer may anger the next. Communication and customer service become at least as important as the technical expertise involved.

Effective communication is vital not only in the field but at the executive level where policy decisions are made. In April, 1991 the Michigan Department of Natural Resources restricted permits for the relocation of wildlife trapped in the metropolitan Detroit area. The restriction called for mandatory euthanasia of all nuisance species trapped, but a strong public opposition and an appeal to the Michigan Natural Resources Commission resulted in a compromise whereby only sick or diseased animals were to be destroyed. While the state had legitimate concerns about the possible spread of disease caused by relocating animals, it underestimated the public’s reaction to mandatory euthanasia, based solely on the county lived in, without a sound, scientific basis for such regulations; there has been little or no known opposition of the euthanasia of sick and diseased animals.

Because environmental sensitivity is at an all time high the information may be useful as well to government agencies involved in policy-making decisions. For example, lethal traps, due to their nonselective nature and various modes of action, may pose a hazard to nontarget animals, pets and children. They are rarely used in urban settings and, then, only as a last resort.

Legal requirements and customer desires are two significant factors which may determine the style or size of the trap to use for a particular animal problem. Federal, state and local regulations may dictate or prohibit certain traps in specific applications. In addition, where the law allows latitude, the customer's desires may impact the selection of the trap. Concern for the higher vertebrates and environmental sensitivity are at an all-time high. Many homeowners prefer live trapping and relocating larger vertebrate pests, as they perceive this method to be more humane. On the other hand, some customers may prefer lethal trapping for fear that the animal may return to cause further problems.

Another consideration for pest control operators (PCOs) is the potential liability that each of these options present. Liability concerns relate directly to the specifications of each job and, therefore, should be addressed individually. The wrong decision can lead to tremendous negative publicity, customer ill will, fines, penalties, revocation of licenses, permits or other regulatory actions.

Status of Nuisance Wildlife Damage Control in the United States

Introduction

Over the last decade there has been an increased interest in the development of standards and recommendations to guide and oversee the growing nuisance wildlife control industry. In an attempt to assess this growing profession, the International Association of Fish and Wildlife Agencies, The Wildlife Society's Wildlife Damage Management Working Group and the National Animal Damage Control Association developed a survey to address the level of state agencies' oversight of Nuisance Wildlife Control Operators (NWCOS). It was hoped that the results of the survey would define the needs of state and federal agencies, and the needs of private NWCOS so they may be better met in the future.

General Information

Currently, 37 states (77%) perform some nuisance wildlife control activities as part of their regulatory duties. The agency's most frequently

specified were state divisions of fish and wildlife (52.8%). Other agencies mentioned were the state departments of agriculture (17%), the state departments of natural resources (9.4%), Animal and Plant Health Inspection Service/Animal Damage Control (APHIS/ADC) (7.6%), county agents (7.5%), and state departments of health (3.8%). Of interest will be whether this will be privatized work as state budgets become more limited.

Although most states perform these duties, 94 percent of states also allow property owners to euthanize some species of wildlife, while 69 percent allow property owners to relocate wildlife as an alternative. Designated private agents are allowed to euthanize nuisance animals for property owners in 39 states, and 32 states allow such agents to relocate nuisance wildlife. There was interest as to whether disease and other concerns will reduce the number of states that allow relocation in the future. The states estimate that 41.3 percent of the NWCOs are part-time, and 43.7 percent are full-time; 25 percent are combined with an existing pest control operation.

State Management

Only 22 states require a license or permit, while 25 states have prerequisites for obtaining a permit or license; 22 did not have any prerequisites. Prerequisites included trapper training courses, NWCO examinations, experience, investigation by the state or an application review process. Nine states have no regulations for the handling of animals or techniques used for damage control work (e.g. type of traps allowed, trap check intervals). Ten states don't regulate the disposition of animals removed for damage control, including relocation, euthanasia or carcass disposal.

While only 22 states require licensing of NWCOs, 27 states require businesses to keep records of actions taken and the disposition of animals removed. Only four states require NWCO businesses to carry general liability insurance.

NWCOs are allowed to pursue accreditation in the use of controlled substances for euthanasia or tranquilizers on wildlife in only 32 percent of the states; this is lower than the percentage of states that allow veterinarians (82%), state wildlife personnel (70%), animal control officers (50%) and law enforcement personnel (48%) to pursue similar accreditation; this makes it difficult for the NWCO to perform the most desirable and humane euthanasia procedures.

Raccoon, squirrel and skunk were most commonly reported in nuisance complaints; deer, beaver and coyote were most commonly reported in property damage complaints; raccoon, skunk and bear were most commonly reported in human health and safety issues.

Ironically, many states have regulations that call for permits to be issued to a landowner on a case-by-case basis; the landowner can then hire a private pest animal control operator but only after an inspection by a game warden or conservation officer. Wildlife agencies do not have the personnel or the time to handle the hundreds of thousands of requests for wildlife damage control, so, oftentimes, the process is ignored altogether.

Many states have a prerequisite for a fur-trapper education course to obtain a permit, which is unrelated to the needs of urban wildlife control. Many of the regulations on the books today were written nearly a century ago, and they have not been updated to meet this new and growing industry.

Another area of frustration for many NWCOs is the inability to obtain permits to handle certain game animals—such as deer, bear and beaver—including certain migratory birds—such as ducks and geese—for which they frequently requested to control. While some states, particularly those with tight budgets, help NWCOs to obtain the proper permits, neighboring states seem to have little interest or ability to do the same.

National Guidelines

States were asked if they would support the development of national guidelines for the NWCO industry, and, if such guidelines were developed, who should take the lead in their preparation. Most states (75%) favored the development of national guidelines as long as they were general in nature and allowed for local conditions. Many states feel guidelines could improve customer satisfaction and the NWCO industry's professionalism. The states that were opposed believed national guidelines would be unable to address local conditions, and some interpreted the guidelines as regulations.

Of the states that favored national guidelines, 38 percent believed that the International Association of Fish and Wildlife Agencies should take the lead, followed by The Wildlife Society Wildlife Damage Working Group (19%), APHIS/ADC (14%), or National Air Duct Cleaners Association (12%). A number of states (17%) believed the responsibility should be shared by all of the organizations.

Licensing of NWCOs

Currently the Humane Society of the United States (HSUS) has drafted wildlife control operator standards (licensing/regulations) that it hopes to help enact through various state legislative bodies to address the needs and concerns related to the NWCO's growing industry. In response, the National Wildlife Control Operators Association (NWCOA) has developed its own draft standards in an attempt to give the private sector greater influence on pending legislation and wildlife regulations. Critter Control has contributed to HSUS's and NWCOA's drafts, and it asked that all the interested parties collaborate effort and complete this sorely needed task. State regulators and fish and game agencies need to take a look at what is available out there and implement new regulations to replace the antiquated ones that are on the books in most states.

Discussion

The private sector is at the interface of a multitude of interested parties when it comes to urban wildlife management, and all the parties should agree that the industry has evolved but needs direction, not to mention modern, related regulations. The main areas of concern are humane animal handling, testing, licensing (permits), insuring and increasing opportunity to assist government agencies by handling species which are currently excluded from permit system. Critter Control welcomes the opportunity to offer its considerable resources and experience to these endeavors, and it strongly encourages those policy and decision makers to get significant input from the private sector before enacting, yet again, antiquated, irrelevant or cumbersome regulations.

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Session Five.
***Bird Conservation: A Foundation
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**Poised to Fly: From Where Have We Come,
and Where Are We Now?**

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Introduction

Throughout recorded history, humans and birds have shared a diverse range of relationships. Those relationships have run the full spectrum, from human dependence on birds for food and survival to total disdain for birds because of perceived or genuine conflicts between their needs and those of humans. As human populations have expanded around the world, true needs for human survival often have become confused with desires to constantly seek new comforts and gratification, often called quality of life. This increased standard of

living has come at a cost that has strained relationships between humans and birds, but interesting ironies have occurred. This paper seeks to review the relatively short history of relationships between humans and birds in the United States and offers some indications as to whether bird conservation in our country is poised to fly into the 21st century.

1600s–1700s

Europeans who settled the United States, beginning in the early 1600s, brought with them an understanding of and regard for birds. For centuries, humans had used wild birds for food and for other purposes. The birds were interwoven into cultural fabrics throughout the world, serving as symbols of strength, love, war, peace and power. Birds were the center of many cultural ceremonies and rituals. Several species were domesticated over time to provide more accessible and reliable sources of food. The settlers also brought with them an appreciation for the special attributes of birds compared to most other types of wildlife. They marveled at the beauty of birds and their ability to fly, and they were attuned with fluctuations in seasonal abundance of some bird species, triggered by the mysteries of migration. Although the negative impacts human activities can have on wild bird populations already had been clearly demonstrated in the Old World, if early settlers brought this awareness with them, it soon diminished as they struggled to survive. They encountered what appeared to be inexhaustible supplies of a wide variety of birds in the New World, and they were quick to take advantage of them.

For most of the century following European settlement of the land that would become the United States, there was little apparent concern for the plight of birds. As the 18th century began, there were those who began to realize that some bird populations were declining, and they took steps to halt or reverse these trends. In 1708, closed seasons were established for heath hens, ruffed grouse, quail and wild turkeys in a few counties in New York. Massachusetts followed suit in 1818, establishing laws to prevent, “wanton destruction of birds which are useful and profitable to the citizens either as articles of food or instruments in the hands of Providence to destroy many noxious insects, grubs and caterpillars which are prejudicial or destructive to vegetation, fruits and grain” (Walker 1955). The Massachusetts laws prohibited take of species of birds, “at improper times,” by protecting grouse and quail from March 1 to September 1 and

woodcock, snipe, larks and robins from March 1 to July 4. Early bird conservation in the United States had its genesis through utilitarian philosophies of the majority of its citizens. However, even in the 1700s a different philosophy was emerging regarding the relationship between humans and birds. There were those who believed birds deserved protection because they were creatures of beauty, grace and inspiration. Thus, the divergence of views, game versus nongame, has been evident in the United States for nearly three centuries. Then, as is the case today, people with these conflicting philosophies were able to rally around a genuine concern for declining bird populations and agreed that take and use should be regulated to ensure that no species would be reduced to extinction.

For most of the 18th century, concern for birds apparently was low. The United States became the new land of opportunity for immigrants from all around the world, but mostly from European nations. During the latter half of the century, the struggle for independence from English rule dominated the lives of citizens of the United States. Concern for wildlife, including birds and their habitats, had little priority during this period; although, there were those who continued carrying the banner, sounding alarm about perceived diminishing populations of certain species of birds.

1800s

As the 19th century began, the United States was a free and independent country. The Lewis and Clark expedition opened the eyes of the fledgling country to the natural capital of the west and included identification of several species of birds new to science. People from around the world flocked to our shores to take advantage of the freedoms and opportunities this new nation offered, and take advantage they did. Human populations exploded, settlement expanded at great rates and wildlife populations, including birds, suffered. Focus on the plight of birds during the 1800s was centered mostly on overexploitation for economic gain, but more subtle events impacting habitat for wildlife, including birds, were having equal or possibly more devastating effects on avifauna in the United States. Forests were cleared, prairies were plowed, rivers were altered to provide avenues for commerce and production agriculture emerged as the economic underpinning in many parts of the United States. These activities, for the most part, were not regulated by federal or state governments. On the contrary, they often were encouraged. For example, in 1849, 1850 and 1860 U.S. Congress

enacted several Swamp Land Acts that resulted in transfer of 65 million acres of swamp and overflow lands to 15 states, mostly in the floodplain of the Mississippi River. The states quickly transferred these lands to private entrepreneurs free of charge or at bargain prices with the expectation that they would be drained and converted to more useful purposes. Ironically, as natural overflows and saturated soils often negated the original intent of the land conversions, the U.S. Congress began a few decades later to enact legislation to construct large reservoirs and massive levee systems to protect these private investments. Similar legislation encouraged conversion of other lands across the nation, and the pioneer spirit, often driven by an agrarian economy, led to dramatic changes in wildlife habitat across the United States. Most species of wildlife, including birds, experienced declining populations. Some species became extinct and others were extirpated in major portions of their range. The 19th century was a time of rapid change and a harbinger of even more draconian changes to follow in the next 200 years.

Regulations affording protection to birds from human exploitation emerged during the 1800s. These regulations, enacted by individual states, were directed mostly towards game birds until 1850, when Connecticut and New Jersey enacted legislation prohibiting killing of several species of birds. Several other states passed similar laws in subsequent years, and, by 1864, 12 states and the District of Columbia had laws protecting many species not generally taken for human consumption. These laws used words such as “harmless,” “small” and “insectivorous” to separate protection of these species from regulations regarding take of species traditionally used for food or other human purposes. Laws established in the 1800s generally were confined to northern states; therefore, little protection existed for migratory birds during their fall and winter sojourns south. Furthermore, large groups of birds, including herons, gulls, terns, owls, raptors and many shorebirds remained totally unprotected.

While regulations were being established to protect birds in parts of the United States, little attention was given to enforcement. In addition, where bag limits were imposed for game birds, they were generally high and provided little protection. Public apathy prevailed and enforcement of bird protection laws was not a high priority anywhere. These factors led to formation of two organizations that would provide an important foundation for bird conservation as the 19th century came to a close. These organizations were the American Ornithologists’ Union (AOU), formed in 1883, and the Audubon Society; founded in 1886.

The AOU, formed primarily as an association for professional ornithologists to promote the study and taxonomy of birds, had a significant impact on bird conservation. Its Committee on Protection of North American Birds provided the avenue through which scientists could enter the debate of bird protection laws. In 1886, this committee published a bulletin entitled, *Destruction of Our Native Birds*. This bulletin included proposed text for state laws to protect birds, which, ultimately, became known as the AOU Model Law. This model, developed by professional scientists, provided potential for uniformity among states, and it was brief and simple. It proposed state-controlled take of birds in four orders: Anatidae, Rallidae, Limicolae and Gallinae. And, all other birds, except the English sparrow, would be protected. Another important section of the AOU Model Law addressed protection of nests.

The Audubon Society was originally chartered as a citizens' group formed for the single purpose of advocating, "protection of wild birds and their eggs" (Walker 1955). The organization enjoyed immediate and enthusiastic support signaling a growing concern among the U. S. populace for the plight of birds. Within the first 18 months of its existence, the Audubon Society attracted more than 37,000 members.

In the mid-1880s, it appeared that a formula for bird conservation in the United States was emerging. From the AOU came the professional, science-based call to action on behalf of birds. And, from the Audubon Society came the citizen response to that call. However, by the end of the decade enthusiasm among these bird conservation pioneers had waned substantially. At the outset, few states adopted the AOU Model Law, and some that did later modified regulations to render them ineffective or repealed them entirely. Within a decade of its foundation in 1886, the Audubon Society had vanished from the scene, apparently for good. The exuberance that prevailed in the mid-1880s to reverse the demise of many species of birds was replaced by gloom a decade later. The status of bird conservation was summarized in 1895 by William Dutcher, a member of the AOU Committee on the Protection of North American Birds and later President of the National Association of Audubon Societies: "At the close of 1895 the low ebb of bird protection had come and the end of the first cycle was at hand. . . . [T]he cause of bird conservation seemed hopeless, for the movement that started so brilliantly in 1883 was seemingly dead after a short career of twelve years" (Walker 1955).

However, the fledgling bird conservation movement was resilient. In 1896, the Audubon Society reorganized and decentralized, establishing

organizations at the state level in recognition that advocacy had to be directed where authority prevailed. States began adopting the AOU Model Law, and citizen support escalated to keep those regulations intact. By 1900, state chapters were established in 20 states with 40,000 members. A national federation to link these state groups was formed. Prominent and influential citizens became engaged in the bird conservation movement and the revitalized efforts were not totally confined to the states. In 1897, bird conservation advocates began working with Representative John F. Lacey of Iowa to secure national legislation that connected regulations concerning wildlife in the various states.

The primary target of nongame bird conservationists during the last quarter of the 19th century was the millinery industry. In 1876, J. A. Allen wrote, “The herons, nearly useless as food, have suffered an immense decrease in numbers...often through wholly reprehensible acts of wantonness. Many have of late been destroyed for their feathers...with which nature has unfortunately adorned them” (Walker 1955).

During the last quarter of the 19th century, it became fashionable for women to wear hats with parts or entire skins of a wide range of bird species. These included birds of every general group. By 1900, the millinery industry was prepared to negotiate with bird conservationists. They proposed, “not to kill or buy any more North American birds.” They wanted to exempt, “barnyard fowls, edible birds, or game birds killed in their season...and birds or plumage of foreign countries not of the species of North American birds” (Walker 1955). Millinery industry leaders asked bird conservationists to accept this offer and “to pledge themselves to do all in their powers to prevent laws being enacted in Congress, or any of the states, which shall interfere with the manufacturing or selling of plumage or skins” of exempt birds. Some leaders of the bird conservation movement supported serious consideration of this proposal from the millinery industry. Fortunately, consensus was to reject it and momentum for meaningful bird conservation continued.

As the 1800s gave way to the 20th century, the all-important third leg of the proverbial stool had been identified. That was political process and support. This third leg, accompanied by a scientific base and citizen support allowed the bird conservation stool to stand as the 1900s began.

As we review the history of bird conservation during the 1800s, a period often referred to as the Exploitation Era, we must remember the words of Daniel A. Poole and Richard A. McCabe who, in 1987, wrote, “Nowadays, we think

back on the resources exploited by this country's pioneers and settlers, and shake our heads sadly, knowingly, and self-righteously. But we fail to realize...the 1800s was the time that kindled this Nation's greatness. It fashioned the spirit of free enterprise and self-determination. It availed unbounded opportunities for personal and societal well-being, and it ultimately fostered an awareness of the need for conservation."

1900s

The bird conservation movement had its genesis in the late 1800s and it took flight in the first few decades of the 20th century. States began to widely adopt regulations based upon the AOU Model Law, and state wildlife agencies were formed. The Lacey Act provided vital federal protection by prohibiting interstate transportation of wildlife, including birds taken illegally. President Theodore Roosevelt set aside millions of acres of federally owned land to be preserved, ensuring key habitat for birds and other wildlife and citizens who enjoy them. In 1903, Pelican Island National Wildlife Refuge was established as the first in a system that today includes 535 refuges in all the states, covering 95 million acres. The National Wildlife Refuge System provides critical habitat for birds throughout the United States.

On the federal scene, in 1913, the Weeks-McLean Act was passed by Congress, placing jurisdiction for migratory birds in the hands of the federal government. In 1916, the United States and Great Britain (for Canada) signed the Migratory Bird Treaty, and, two years later, the Migratory Bird Treaty Act was passed. The Migratory Bird Treaty Act was the basis for subsequent bird conservation treaties with Mexico in 1936, Japan in 1972 and Russia in 1976. The Migratory Bird Treaty Act, providing federal jurisdiction for migratory birds, is still the fabric of bird conservation in North America, but state and provincial wildlife agencies and nongovernment organizations are vital partners necessary for successful delivery of bird conservation programs.

Establishment of the National Association of Game and Fish Wardens and Commissioners, in 1902 was a monumental step forward in bird conservation. This organization, later to become the International Association of Fish and Wildlife Agencies, was formed to provide a forum for cooperation and coordination among state fish and wildlife agencies. Its early agenda included development of guidelines and proposals urging states to establish hunting and

fishing permits with fees to provide funding for enforcement of wildlife regulations. From this rather meager beginning came the foundation for state hunting and fishing permit systems that, collectively, have provided most of the direct funding for wildlife conservation. In addition, it highlighted the importance of enforcement in reversing downward trends in wildlife populations, including birds.

Other focal points for the National Association of Game and Fish Wardens and Commissioners were the enactment of a ban on spring harvest of migratory waterfowl and the prohibition of market hunting. Both of these concerns were generated by dwindling populations of birds and other wildlife. It would be more than 30 years before efforts on these fronts would yield the desired results. With a growing foundation of federal responsibility for migratory birds and concerted efforts to improve coordination among state wildlife agencies, a critical federal-state partnership was emerging that a century later is still the key to successful bird conservation.

The 1920s were a time of self-indulgence among U.S. citizens. Although many of the pieces to the bird conservation puzzle were available, little priority existed for putting them in place. Populations of many species of birds continued to decline. This period of conservation complacency came to an abrupt halt in the 1930s as much of North America was gripped in a drought of monumental proportions. The impacts of abuse of the continent's natural resources, especially its land, became painfully obvious. This awakening led to actions that could arguably be called the most important in the history of bird conservation in the United States.

In 1934, Roosevelt appointed a committee on wildlife restoration. Members were Thomas Beck, Jay W. "Ding" Darling and Aldo Leopold. Their first actions involved a recommendation to appropriate \$50 million for the rehabilitation of marginal lands as a keystone of wildlife restoration. Simultaneously, they called attention to the dismal plight of migratory birds. Efforts of this committee and other conservation pioneers resulted in quantum leaps forward for birds. Among these efforts were passage of the Duck Stamp Act in 1934, establishment of Cooperative Wildlife Research Units in 1935 and enactment of the Federal Aid in Wildlife Act (Pittman-Robertson) in 1937. The Duck Stamp Act provided an avenue for generating funds for migratory waterfowl refuges. The Federal Aid in Wildlife Act provided a major funding boost to state wildlife programs through taxes on hunting equipment and

ammunition. Equally important, in this act was the provision that required states receiving these monies to dedicate all receipts from the sale of hunting licenses for use by state fish and game department and not for any other purpose. This provision has protected millions of dollars from raid by state legislatures for more than 65 years.

Cooperative Wildlife Research Units have been the core of the wildlife profession. They have produced the majority of professional wildlife managers and often have been at the center of wildlife research, including investigations that are the basis of bird conservation.

Nongovernment organizations promoting bird conservation also emerged in the 1930s. Notable among these were the American Wildlife Institute, in 1935 (later to become the Wildlife Management Institute), the National Wildlife Federation, in 1936, and Ducks Unlimited, Inc., in 1937. These and other organizations focused on advocacy or habitat restoration, both elements vital to bird restoration and management in the United States.

Another milestone in the 1930s, rarely discussed among bird conservationists, was the work done by Fredrick Lincoln. He analyzed recoveries of banded waterfowl and suggested flyways as units for management. These efforts were the first suggestion that geographic units with biological similarities provide a sound basis for bird conservation.

The primary building blocks for modern bird conservation were crafted and the first significant funding emerged in the 1930s. At the center of these efforts were hunters concerned about the plight of game species. They promoted legislation, regulations and policies that would reverse the downward trends in bird numbers experienced through much of the nation's history. In addition, they were willing to pay their way. In fact, even today's hunters, through license fees, special taxes and contributions to conservation organizations, provide a substantial portion of the financial support for bird conservation.

The success of bird conservation efforts from the 1940s through the current time are numerous and well chronicled. Millions of acres of habitat have been conserved by federal, state and private efforts, and many bird populations prosper. Federal and state laws have been passed and strengthened to compliment earlier legislation that provides for bird conservation. Citizen support for all environmental protection continues to escalate. Our knowledge of birds and issues impacting their survival has been greatly enhanced through research during the last half century. However, despite successes in the past 60 years,

conflict between birds and humans continues and the implications are not good for birds. The direct impacts of large-scale land conversion to agriculture and urban centers have greatly reduced bird habitat. Pesticides and other environmental pollutants have been implicated in the continued decline of some species. Water resource projects, built to meet growing human demands, have placed additional stress on birds. Without addressing these and other factors, the future of many bird populations in the United States will be jeopardized.

Fortunately, significant milestones in bird conservation have been achieved in the past 20 years. In 1986, the North American Waterfowl Management Plan (NAWMP) was signed by the United States and Canada, and Mexico became a full partner with a 1994 update. In 1989, the North American Wetlands Conservation Act was passed by Congress, providing the core funding for the waterfowl plan. Implementation of the NAWMP illustrated the power of partnerships and demonstrated that diverse interests could merge to achieve common objectives for waterfowl conservation. Delivery of the NAWMP led to establishment of joint ventures, locally administered partnerships open to all stakeholders. Joint ventures, or similar approaches, are held as the model for delivering other bird conservation initiatives. Conservation plans for land birds, water birds and shorebirds have been developed, and national plans for bobwhite quail and grouse are in formative stages. These national plans are being linked with Canadian and Mexican efforts under the banner of the North American Bird Conservation Initiative. Some joint venture management boards, established to deliver the NAWMP, have embraced objectives of the other bird conservation plans and are developing the biological foundations for merging them under an all-bird conservation program.

Other accomplishments, while not directly related to bird conservation, are equally or more important. They represent a growing environmental awareness among landowners and the nation's citizenry. Since 1985, each new Farm Bill has included successively stronger conservation titles. The Conservation Reserve Program, the Wetland Reserve Program and the Wildlife Habitat Improvement Program benefit birds. In the public works arena, increased public scrutiny has resulted in enhanced accountability and mitigation of environmental losses from water resource projects. The economic benefits of wildlife, particularly birds, are being realized. Bird watching is among the fastest growing outdoor recreation activities and, combined with hunting, eco-tourism and other bird-related pursuits, it generated more than \$42 billion in 2002. This

represents 38 percent of the total economic impact of wildlife-related recreation in the United States.

Where Are We Now?

There are reasons, among bird conservationists, to be excited. However, all is not good. Many populations of birds, particularly those associated with wetlands, grasslands, early succession and interior forests, are suffering long-term declines. Birds impacted are not confined to un hunted species. Pintails, lesser scaup, woodcock and bobwhite quail are species of concern. Even with all of the conservation efforts in place, there are still annual net losses for many habitat types, including over 100,000 acres of wetlands.

One of the major problems facing bird conservationists as the 21st century unfolds is inadequate funding to meet the needs of birds. Throughout history, efforts in bird conservation, and all wildlife conservation for that matter, have been fragmented and sometimes adversarial. We have dealt with fish versus wildlife, game versus nongame, waterfowl versus upland game birds and birds versus mammals. This division has resulted in special interest groups, often led or encouraged by professional biologists arguing over already inadequate sources of funding. In the future, these special interests must consolidate efforts to increase existing funding sources and develop new ones.

During the 1980s and early 1990s, as ecosystem management was the buzzword among the conservation community, Jack Ward Thomas often espoused, "Ecosystem management is not more difficult than we think. It is more difficult than we can think." Integrated bird conservation may well fall into that category. However, Thomas apparently was referring to us as individuals. If we will set aside our special interests, respect the differing views among us and build upon the growing public and political support for protecting birds, bird conservation will remain as the hallmark for all wildlife management efforts. We are indeed poised to fly. Will we soar to new heights in conservation or will we plummet to the ground? The answer to that question is dependent on our vision for bird conservation and, ultimately, our actions.

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A New Paradigm for Bird Conservation: The Role of Applied Science in Conserving the Full Spectrum of North American Birds through Regional Partnerships

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Introduction

The North American Waterfowl Management Plan (NAWMP) is widely credited with reinventing approaches to conservation. For the first time, conservationists from the private sector joined representatives of state, provincial, federal and corporate entities in an effort to affect populations of birds at a continental scale. Despite past successes of the NAWMP and joint ventures partners assembled under the NAWMP banner, persistent forces continue to diminish the quantity and quality of bird habitats. In most areas of North America, changes in habitat abundance and quality are the cumulative effects of decisions by individual land owners to alter existing land use. Government programs often exert a profound influence on those decisions. To underscore the extent to which these programs may effect bird habitats, U.S. Farm Bill expenditures in 2001 exceeded \$16.4 billion for farming subsidies (not including crop insurance subsidies or \$2.4 billion in disaster payments) and \$1.9 billion for conservation titles (Environmental Working Group 2003). In many parts of the United States., bird conservation lives and dies through the conservation provision of the current Farm Bill; yet, it is the tension between commodity payments and conservation payments—bringing new land into production on one hand, encouraging habitat

restoration on the other—that ultimately determines net changes in the nationwide availability of wildlife habitat. Although many speculate that the 2002 Farm Bill will contain the largest expenditures for conservation of any to date, the ratio of commodity to conservation spending is expected to be essentially unchanged. In contrast to expenditures for agriculture, in 2002, combined direct federal expenditures for bird conservation totaled less than \$121 million (James Woehr, personal communication 2003).

In the face of continuing habitat losses, most successes by bird conservationists will be transient. In fact, traditional approaches to habitat conservation that rely on direct appropriations for wildlife management might be characterized as doing little more than delaying inevitable habitat degradation and declines in bird populations. Clearly, the challenge of conserving the full spectrum of North American birds and their habitats dwarfs traditional wildlife management resources. Overcoming these deficits will require that we make more efficient use of our traditional resources and that we broaden our reach to more effectively capture the potential wildlife benefits of a host of federal and state programs that use habitat restoration as a tool to secure diverse environmental quality and socioeconomic benefits. Successfully refining delivery of programs, like the Farm Bill, to increase their benefits to birds and other wildlife will require expanded partnerships that are based on more sophisticated approaches to conservation that embrace science-based, strategic planning and implementation at continental, regional, landscape and local scales. This approach is predicated on the revolution in information management technology. In this paper, we will explore the idea of a new paradigm for bird conservation and how this paradigm shift may lead to a broader sphere of influence for conservationists.

Reinventing the Bird Conservation Paradigm

Traditional approaches to habitat management may be characterized as dependant on direct appropriations to land management agencies and to programs such as the North American Wetlands Conservation Act explicitly for the purposes of protecting and managing wildlife habitats. Funds for habitat protection have typically been expended opportunistically, with little regard to predicted biological consequences and without coordination among conservation agencies working within the same landscape or seeking the same goals (Figure

1). Using these relatively limited traditional resources more strategically and broadening our reach to nontraditional partners will require a new conservation paradigm. The new paradigm will require new approaches to the business of bird conservation and new ways of thinking about our agencies' roles in habitat management. We can no longer regard our roles as solely habitat stewardship. Under the new paradigm, we will be purveyors of information that captures the biological foundation for bird conservation, that is, our understanding of how birds relate to their habitats across space and time during the annual cycle. Understanding the new demands of bird conservation begins with a critical assessment of the goal of, "regionally based, biologically-driven, landscape-oriented partnerships" (North American Bird Conservation Initiative 2002). Recognizing the implied commitment in this goal to a new model for conservation requires that we break the goal into its basic elements (Baxter 2003).

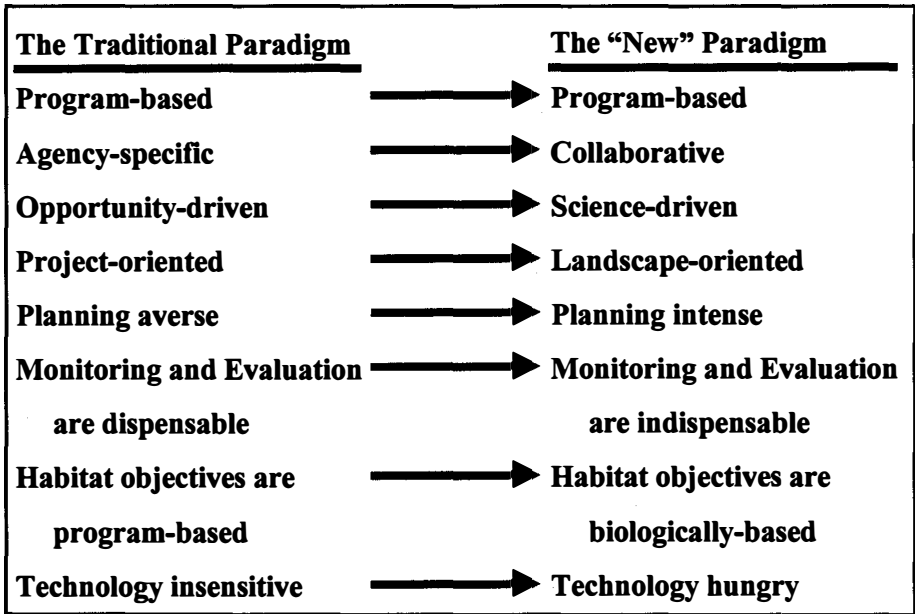


Figure 1. Contrasting elements of the traditional conservation paradigm with the "new" paradigm.

The phrase *regionally-based* presumes that habitat objectives and conservation strategies will emanate from ecologically-defined units that reflect our best understanding of how birds respond to habitats throughout their annual cycle, much as the founders of NAWMP envisioned for waterfowl. Just as

flyways provide the unifying geographic theme for the regulation of harvest, ecological units, like bird conservation regions (BCR's), provide a comprehensive, geographic framework for planning, implementing and delivering bird conservation programs and the foundation for partnerships that will be increasingly interstate and international in focus.

The demands of *biologically-driven* are perhaps best understood by considering its converse: opportunity-based conservation. In a biologically-driven partnership, conservation does not operate on the basis of an opportunistic pursuit of habitat gains. Instead, it is driven by specified biological objectives and spatially-explicit priorities. A biologically-driven conservation plan demands a departure from the traditional programmatic, opportunistic approach to conservation in at least three key areas.

First, it requires that habitat objectives be linked to population response at multiple scales (e.g., population management). Secondly, we must draw a clear distinction among: (1) the biological planning demanded by a population-driven approach to conservation, (2) the conservation planning required to design sustainable landscapes and (3) the programmatic planning needed to focus our resources on attaining our objectives. In this regard, biological planning and landscape planning require a commitment to monitoring, evaluation, and research. Therein lies the third demand of a biologically-driven partnership—creating a clear link between science and management. This link is nothing more than explicitly stated, testable assumptions about how populations are presumed to respond to habitat manipulations. If we articulate as models the assumptions upon which management operates, we will provide focus for research and a framework for monitoring and evaluation.

A *landscape-oriented* approach to conservation focuses on: (1) translating models of population-habitat relationships into spatially-explicit priorities at multiple scales and (2) developing the decision support tools and conservation blueprints that guide integrated bird conservation. This approach demands that conservation delivery be discriminatory. That is, delivery programs operate in tandem, in awareness of one another, discriminating between and among landscape features and priorities, pursuing a preestablished design of predicted sustainability.

A commitment to biologically-driven conservation planning carries with it an implicit commitment to set aside opportunistic approaches to habitat protection and management that have dominated the traditional conservation

paradigm. By adopting the goal of biologically-driven, partnership-based conservation for all birds, we place ourselves in the vanguard of a new approach to wildlife management. It is appropriate that migratory bird conservation lead the way in developing and implementing the new conservation paradigm. The migratory nature of birds and the diversity of habitats upon which they rely requires that we consider the conservation potential of all parts of all landscapes. This demands thinking at continental scales, yet we must facilitate conservation at the local level where all habitat management occurs. The need to integrate planning and management across spatial scales is fundamental to the new paradigm.

Although our goal is based upon the three key elements outlined above, sound biological planning is the foundation upon which sustainable landscapes are built. Thus, a primary challenge in achieving integrated bird conservation is following a defined biological planning process (Figure 2) with anticipated products (Table 1) for each suite of birds (e.g., waterfowl, landbirds, shorebirds, waterbirds).

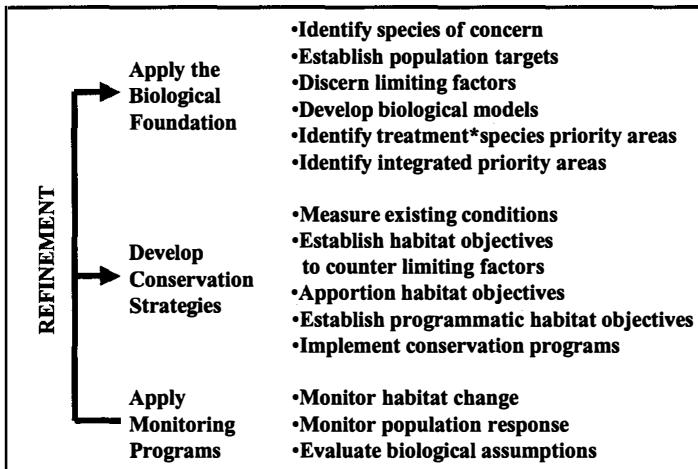


Figure 2. The biologically-driven planning process.

Table 1. The products of regional biological planning.

1. Regional species priorities developed in a continental context
2. Population targets that emanate from national and continental population objectives
3. Population-based habitat objectives expressed at multiple scales
4. Geographic priority areas for the conservation of priority species
5. Population and habitat monitoring programs and research directed at testing model assumptions and assessing progress toward population goals

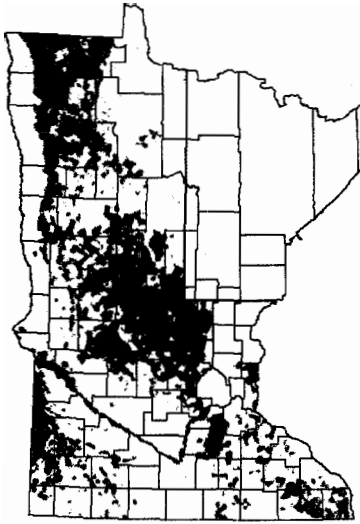
Biological Planning

The fundamental premise of each major bird conservation initiative is that the cumulative effect of many local conservation actions will result in dynamic, but sustainable, landscapes that are capable of providing for the physiological needs of birds at prescribed population levels. The challenge facing bird conservationists is the development of cohesive regional conservation strategies that will lead to the attainment of continental population objectives.

Biological planning is a method of developing strategies that increase the efficiency with which we conserve bird populations through the systematic application of biological knowledge. It culminates in a landscape design that prescribes the most appropriate management treatments to the best areas for affecting populations of priority species. The products of biological planning are transparent in their derivation and defensible because they are based on the best available science with an explicit acknowledgment of critical assumptions as a guide to monitoring and research. Thus, biological planning provides conservation quality assurance that may enhance our credibility as natural resource managers.

Unlike traditional opportunity-based conservation, biologically-driven conservation is founded on the idea that every part of a landscape has a unique and optimal management decision associated with it. These decisions are based on the interplay of the predicted biological consequences of management, the social costs and the management costs. Because conservation plans with these attributes include a geographic component, they are referred to as spatially-explicit plans.

The basis for biological planning is models which are quantifiable statements about our understanding of how birds relate to their habitats and about how habitats affect populations; they enable the systematic identification of priority management areas, the logical development of habitat objectives and the estimation of the impacts of management actions on populations. Models may be mathematical or statistical, derived from research or monitoring data, or heuristic statements (i.e., performance is improved through evaluation feedback) about species-habitat relationships that often, but not necessarily, include empirically-based parameter estimates (Figure 3). In the absence of empirical models, heuristic models are useful because they enable management to proceed in the face of imperfect information, but with the best biological guidance available. Often, systematically applying an informed set of assumptions about bird-habitat relationships results in better management decisions than a more haphazard application of management treatments.



Predicted Habitat Suitability for Marbled Godwits (*Limosa fedoa*)

Patch size - ≥ 320 acres

- a) $< \frac{1}{4}$ mile wide = poor
- b) $\frac{1}{4} - \frac{1}{2}$ mile wide = good
- c) $> \frac{1}{2}$ mile wide = best

Percent grass within 2 miles

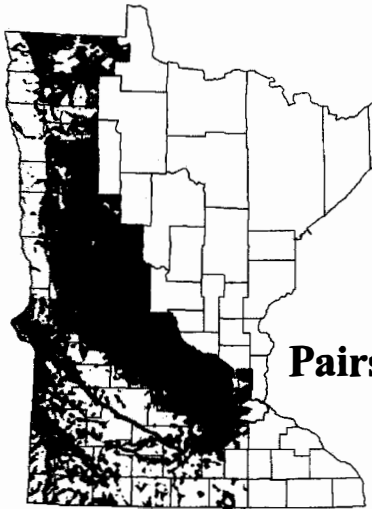
- a) $< 10\%$ = poor
- b) $10-30\%$ = good
- c) $> 30\%$ = best

Topography - coefficient of variation within 90 ha

- a) $CV > 1$ = poor
- b) $CV < 1$ = good

Trees - must be > 100 m from trees

Wetlands - must have 4 acres temporary and/or seasonal wetlands within 320 acre patch



**Predicted Mallard (*Anas platyrhynchos*)
Pair Accessibility to Upland Nesting
Habitat**

$$\text{Pairs} = 2.718[-1.26 + 0.55(\ln \text{size}) + \alpha]$$

Figure 3. Heuristic (above) and empirical (below) models are both appropriate for biological planning, provided their inherent assumptions are identified and tested.

Unfortunately, models are developed with an imperfect understanding of the processes that regulate bird populations. Whether based on empirical or heuristic models, biological planning implies a commitment to monitoring and assessment in order to ascertain if models are providing accurate predictions.

Planning is part of an iterative cycle that includes implementation, evaluation and planning anew. Planning without evaluation and continuous plan updating breaks this cycle and diminishes management effectiveness.

Biological models may be used to track management accomplishments in terms of predicted consequences to populations. This is desirable because it shifts management from a habitat quantity-based to a habitat quality-based accomplishment tracking system, which is the essence of cost-effective, quality-assured management, which is central to the new conservation paradigm.

Developing Habitat Objectives at Multiple Scales

As we make conservation gains through regional partnerships and as human demand for open space increases, being able to say how much habitat is enough and to defend these estimates will be increasingly important. Under the new conservation paradigm, habitat objectives will be biologically-based on the best currently available science (with acknowledged assumptions), not on program goals or perceptions of what seems realistic to attain.

The relationship of a species to its habitat varies, making the development of habitat objectives at a continental scale impractical. For this reason, biological planning should occur within ecological regions across which the species composition, habitats, management approaches and species-habitat relationships are relatively homogeneous. Regional scale habitat objectives can be rolled up into continental- or national-scale programmatic goals. Consequently, regional-scale biological planning is essential to the strategic implementation of continental or national-scale conservation initiatives.

Regional habitat objectives are generally developed from population objectives and biological models (Figure 2). Many joint ventures have adopted the goal of the integrated conservation of all birds, which complicates the process of developing joint venture habitat objectives and conservation strategies, yet it significantly increases the potential for conservation efficiency. Complexity arises in that different groups of birds may have similar, but seldom completely overlapping, habitat requirements. To capture potential efficiencies requires that we understand the extent to which priority areas for different species overlap through a spatially-explicit integrated planning process. Developing habitat objectives for the conservation of all birds is not as simple as summing the habitat objectives for individual species. Nor is it appropriate to take the largest of the species-specific habitat objectives and assume that there is complete coincidence

in the way multiple species relate to their habitats. Through spatially-explicit, model-based biological planning, we can critically assess the potential of management to benefit multiple species and, therefore, formally estimate the amount of habitat to be protected, restored or altered in a comprehensive regional conservation strategy.

The Value of Regional Partnerships

In the not too distant past, waterfowl joint ventures were looked upon as nontraditional partnerships doing the business of conservation in a new way. The drafters of the 1986 NAWMP realized that restoring waterfowl populations would require more than federal intervention on federal lands with federal funds. Joint venture action groups were envisioned to promote coordination at the project scale among interested stakeholders (NAWMP 1986, 1998). Today, the joint venture approach is the standard against which conservation delivery is measured. Joint venture management boards and technical committees are a nexus for information exchange on conservation, management, economic and social policies and programs that affect bird habitats. Coordination among stakeholders interested in pooling and matching resources for habitat projects remains a primary function.

The new conservation paradigm moves joint ventures farther toward their full potential of delivering coordinated conservation across broad regions of North America. As they begin to think of themselves as purveyors of the regional biological foundation for bird conservation, joint ventures must make greater investments in biological planning and evaluation. This is prudent because no joint venture presently has adequate resources to independently affect bird populations. In fact, no single agency or organization has the scope or resources to singlehandedly conserve bird populations. A rational division of responsibilities among agencies, organizations and programs, that is, a comprehensive conservation strategy, is essential. The greatest added value of joint ventures will be realized when each begins to act as a coordination forum for conservation in the context of a regional conservation blueprint—a community strategy for the conservation of birds and other wildlife that transcends political and jurisdictional boundaries. The new conservation paradigm describes this strategy as biologically-driven at landscape scales, accounting for the full suite of tools available to regional partners through their programs that deliver habitat at local scales.

The National Wildlife Refuge System acknowledged this in its vision document, *Fulfilling the Promise* (National Wildlife Refuge System 1999), when it stated its, “intent to manage refuges as a system instead of disparate units.” This notion views individual refuges within a broader context of conservation lands, allowing each refuge to fulfill its purpose while also working with partners to contribute appropriately to the conservation and management of fish, wildlife, plants and biodiversity in the ecosystems where they occur. To fulfill this goal, explicit population and habitat objectives and geographic priorities at national, regional and refuge scales must be developed through landscape-scale biological planning and applied in partnership-driven development of conservation strategies at national and regional scales. Under the new conservation paradigm, joint ventures will play a pivotal role in coordinating the development and stewardship of these conservation strategies.

Expanding Our Reach

Biologically-driven conservation strategies are founded on a suite of systematically-derived, continuously-updated, population targets, habitat objectives, evaluation priorities and decision support tools that are used to identify priority management areas (Table 1). A comprehensive conservation strategy must speak to multiple users, some of whom chart the direction of program delivery and others that physically deliver programs at a local scale. Each group requires different information and tools to help attain bird conservation goals. Providing this information will require effective inreach and outreach.

Inreach

To attain its goals, a joint ventures must enter into a partnership with field-level habitat managers that make daily decisions about managing habitats. A comprehensive conservation strategy must provide managers with decision support tools that may be used to identify priority landscapes tailored to the application of specific management treatments. Maps are particularly effective tools for describing spatially-explicit priorities because they enable planners to compress multi-dimensional models, describing complex bird-habitat relationships into two-dimensional space. This is particularly important when the model parameters in the decision process are greater than three because few humans

can manipulate four or five dimensional matrices (models based on 4 or 5 variables) in their minds. Managers can readily use the information presented in maps, both for internal management decisions and for public outreach. Perhaps more effectively than any other method, maps may be used to communicate the biological justification for agency priorities, recommendations and decisions.

Outreach to Nontraditional Partners

When asked how much habitat we need for wildlife, the response “as much as we can get” falls short in the face of escalating human demands for resources. New sources of significant funding for wildlife conservation have generally proven to be elusive, examples like the North American Wetlands Conservation Act and state wildlife grants notwithstanding. In part, this is because habitat loss and population declines are insidious, and direct threats to human health or the economy are difficult to demonstrate. Yet, acknowledged crises in environmental quality abound, often with strong public and government support for alleviating them. A principal tool of the government agencies responsible for managing these crises is habitat restoration. Adopting the new conservation paradigm requires that we increase our efforts to reach out to these, as yet, nontraditional partners—agencies for whom bird conservation is, at most, a secondary goal—to aid them in refining the delivery of their programs with the explicit goal of increasing the benefits to birds of the habitats they restore.

Experience has proven that nontraditional partners are frequently willing to reshape the delivery of their programs to benefit birds and other wildlife, especially when broader benefits may be attained with little or no loss in efficiency in attaining primary program goals. In the words of a state department of transportation employee, “we want to mitigate wetland losses by restoring wetlands where they can provide greatest overall good.” However, the degree to which we will be able to affect the delivery of these programs depends on our willingness to bring unique resources to the partnership, not just an expectation of deriving benefits for birds. Under the new conservation paradigm, our contribution will be a strong biological foundation for bird conservation captured in credible conservation strategies based on the best available science.

When working with nontraditional partners, a conservation strategy must provide guidance at national, regional and local scales that enables nontraditional partners to formulate program objectives and identify priority program delivery

areas. Furthermore, our strategies should be communicated with the understanding that they will change as the science for management improves through research, monitoring and assessment. Generally, nontraditional partners will adopt our conservation strategies more readily if they are engaged during the planning process. A recent example illustrates how this partnership-based conservation planning may lead to gains for bird conservation.

A Community Strategy for Wetland Restoration. Wetlands were a dominant feature of the prairies of Minnesota and Iowa at the time the area was first occupied by humans of European descent. However, the lure of fertile soils and a strong work ethic converged in an unprecedented effort to drain prairie wetlands. In many watersheds, fewer than 5 percent of the original wetlands still exist (Bishop 1981). Although not all of the consequences of this intensive wetland drainage are understood, they are thought to include water quality degradation and increased flood frequency and intensity along mainstem rivers and major tributaries. Today, wetland restoration is increasingly favored as a means of providing multiple natural resource and socioeconomic benefits. These multiple benefits are most likely to accrue when restorations are conducted in the context of a comprehensive strategic restoration plan. An essential precursor to such a plan is spatial information about the distribution and extent of drained wetlands. In 2001, a team of U.S. Fish and Wildlife Service biological planners of the Prairie Pothole Joint Venture assembled a small group of natural resource managers, self-titled the Restorable Wetland Working Group (RWWG), to assess the feasibility of mapping restorable wetlands at watershed scales. Today, the RWWG is comprised of nearly 30 participating or contributing agencies and organizations. They include many traditional wildlife entities, but the majority of its members come with different environmental agendas. Among others, these groups include county soil and water conservation districts, clean water partnerships, watershed management boards, the U.S. Army Corps of Engineers, the Minnesota Pollution Control Agency, the Minnesota Board of Water and Soil Resources, and the Minnesota Department of Transportation. The RWWG is developing a comprehensive digital data layer of drained and restorable wetlands in the intensively farmed areas of the eastern Prairie Pothole Region, and teams have recently begun to develop and apply models to this data to develop a comprehensive, cross-jurisdictional strategy for wetland restoration that yields wildlife, water quality enhancement and flood damage reduction benefits (Figure 4). Within the context of this strategy, agencies will select

**Potential
For Multiple
Environmental
Benefits**

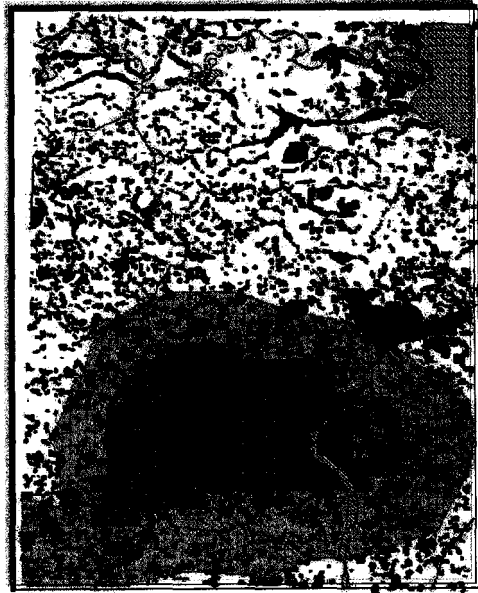
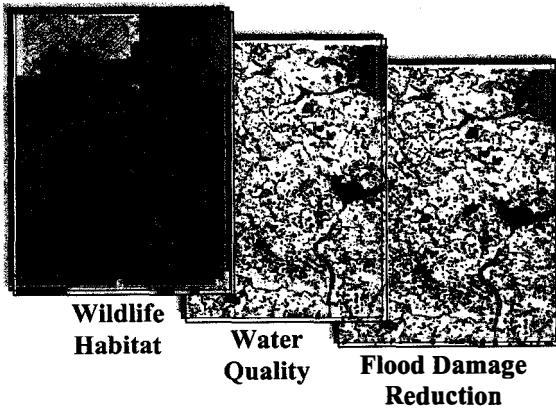


Figure 4. A model-based community conservation planning tool for wetland restoration for a 50 mi² area of Jackson County, Minnesota. Darker shades indicate wetlands predicted to provide significant multiple environmental benefits. The shaded landscape in the center is a model-based priority restoration focus area for migratory birds.



restoration sites that optimize attaining their primary objectives as well as the collateral benefits from restoration, thereby increasing their cost effectiveness. To date, restorable wetlands data has been used refine watershed management plans developed by soil and water conservation districts and watershed management boards, to focus multi-agency restoration expenditures on key wetland complexes, and to direct landowner outreach for the U.S. Department of Agriculture Farmable Wetlands Pilot Program. The RWWG anticipates that this community wetland restoration strategy will enhance interagency

cooperation and coordination, thereby reducing future conflict over wetland alteration and mitigation, and bird conservationists expect to reap greater benefits from wetland restoration programs targeting nonwildlife functions.

Summary

Successfully meeting the challenges of bird conservation demands a shift in habitat management from traditional opportunistic, project-oriented approaches to a new paradigm that is based on the implementation of collaborative, landscape-oriented strategies, which are derived from biological planning. Biological planning links program-based delivery, scalable habitat objectives and regional population targets, and, as such, it improves conservation efficiency and management credibility. Under the new paradigm, wildlife managers will be purveyors of the biological foundation for bird conservation, and regional partnerships, like joint ventures, will expend greater resources on biological planning and on coordinating the development and implementation of community conservation strategies. This facilitates nontraditional partnerships with government agencies that use habitat management to attain various socioeconomic and environmental benefits, but for whom bird conservation is, at most, a secondary goal.

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A Research Agenda for Bird Conservation

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As conservation efforts—like Partners in Flight, joint ventures under the North American Waterfowl Management Plan, and other planning and management programs have matured over the last decade, bird conservation has become an increasingly focused and organized movement. Avian conservation is now supported by legislation, like the North American Wetlands Conservation Act (16 USC Sec. 4401) and the Neotropical Migratory Bird Conservation Act (16 USC 6101), and is reflected in land conservation programs, e.g., the Farm Security and Rural Investment Act of 2002 (PL 107–171) and the budgets of many federal and state agencies. By now, we have a clearer understanding about the role of habitats in conserving populations and a better sense of the public and political awareness that is necessary for effective conservation. There is a growing body of knowledge about biological processes and their linkage to landscapes, about the appropriate methods for monitoring and assessment, and about approaches to the sharing of this information among conservation partners. Nevertheless, there remains considerable uncertainty (and sometimes controversy) about many aspects of avian biology and the need for better biological information on which to base conservation decisions. The objective of this paper is to highlight some information needs for avian biology, as they have been recognized and articulated by avian conservationists and scientists.

Background

Though information deficits in conservation become obvious when conservation programs are large and complex, they also can be seen in the choice of even simple interventions. Consider, for example, the conservation of avian biodiversity involving two areas that are geographically separated but proximate, with high biodiversity recorded on one area, but not the other. With limited funding for habitat conservation, a relevant question is whether funds should be used to conserve either or both these areas. Perhaps surprisingly, and irrespective of any concerns about the survey methodology used to assess biodiversity, this question

cannot be answered effectively, based on survey information from the areas only. Depending on the ecological attributes of the adjacent lands, both areas may be ecological sinks (Pulliam 1988, Conroy and Noon 1996), primarily attracting organisms from the surrounding landscape and contributing little conservation value. Or, both areas may be ecological sources that produce an abundance of biodiversity, thereby contributing high conservation value. Or, the area with lower biodiversity could be an ecological source worth conserving, with the more diverse area a sink not worth conserving, or vice versa. The point is that one cannot determine the most effective conservation strategy for the region without additional information about biological processes, such as reproduction, survival and dispersion within and among the areas. This problem is compounded when biodiversity is but one value motivating conservation, along with other values, such as endangered species protection and preservation of unique ecosystems.

Difficulties in making sound decisions in the absence of adequate information can arise whether one's focus is on single-species or multi-species assemblages, on game or nongame management, or on local or landscape scales. But, they are perhaps most obvious with avian conservation through habitat management. Biologists involved in habitat conservation generally recognize the importance of science as the basis for effective decision making, and they acknowledge the limitations on sound conservation and management when scientific information is not available. They rely on ongoing monitoring and biological assessment to obtain that information to recognize which birds are most vulnerable and are heading for trouble, which habitats are most important for conservation, which biological processes are controlling and most in need of intervention, which interventions are most appropriate, and the way to respond to interventions. Without reliable, up-to-date, scientific information on factors like population trends, distribution patterns, and habitat availability and use, these questions remain unanswered, and one's ability to wisely allocate scarce resource dollars is greatly reduced.

Framework for Avian Science

In what follows, the collection and use of scientific information are described in the context of adaptive resource management (ARM) (Holling 1978, Walters 1986). In an adaptive approach, science is seen as supporting conservation through the production of useful information about biological

structure and function. Conversely, conservation is seen as supporting science through interventions that are useful in investigating the resource system (Williams 2003). Importantly, ARM recognizes an asymmetry in these bi-directional relationships, in that the purpose of scientific inquiry is to help to achieve the goals of management, not the other way around.

The linkage between science and management in ARM provides a natural framework for informed natural resource conservation. A key role is ascribed in that framework to planning, specifically to the articulation of conservation goals and the identification of decisions pursuant to their achievement. Planning is thought of as a vehicle to guide conservation actions, while in turn being guided by resource assessment. A scenario for conservation thus describes decision-making as an iterative process, in which planning leads to interventions, with the impacts of the interventions recorded through monitoring, with the resulting monitoring data used to assess resource status and trends. That assessment is used, in turn, to inform future planning, thereby starting another cycle in the conservation process (Ruth et al. 2002, Williams 2003).

Information Needs

The information needed to support avian conservation has been discussed many times in many forums. Good examples include conservation planning efforts embodied in the North American Waterfowl Management Plan, North American Shorebird Conservation Plan, North American Waterbird Conservation Plan, Northern Bobwhite Conservation Initiative and Partners in Flight planning documents. Many of the needs expressed in these and other plans have been captured in action plans (e.g., Williams et al. 1999, Pashley et al. 2000, Brown et al. 2001, Dimmick et al. 2002, Kushlan et al. 2002) and have been synthesized in documentation for the North American Bird Conservation Initiative (U.S. North American Bird Conservation Initiative Committee 2000). Federal, state and non-governmental biologists have focused on science information needs in numerous discussions, workshops and symposia, and there is a large, popular and scientific literature documenting the results.

Almost all these sources have emphasized, to one degree or another, key roles for monitoring bird populations and the habitats they use. They also emphasize biological analysis and assessment, especially as it connects populations, habitats and digital information management and sharing. An

example that synthesizes much of this work is the research strategy developed through the North American Bird Conservation Initiative, which includes the following elements:

- monitoring, including both population and habitat monitoring; monitoring is viewed here as a cornerstone of research and assessment, since spatial and temporal variation in population and habitat data can support linkages between population dynamics and habitat structure
- modeling and analysis, including population models, demographic research, habitat assessment and the identification of linkages between populations and habitats; modeling in this context includes the estimation of vital rates and the identification of environmental drivers that influence them
- information management, utilizing digital information technologies and web-based data sharing; in the context of avian information needs, this includes assessment and synthesis of data nationwide and development of a geomatics network for data distribution and sharing
- decision support tools for summary and display of information and for recognizing biologically relevant spatiotemporal patterns; the focus is largely geographic, involving the use of geographical information system, image processing and other spatial modeling and pattern recognition technologies.

A more comprehensive program for conservation-oriented science and information in avian biology is given in Ruth et al. (2002). The authors documented the results of a recent workshop, involving 65 scientists and conservationists from academia, government and conservation organizations, with the goal of, “identifying the key areas of research needed in this new era of bird conservation science.” Workshop participants identified the following five priority areas, which serve as a framework for describing information needs.

Avian history, populations, and ecology. Included in this broad category are studies directed at the distribution, life history and population dynamics of avian species; the monitoring of protocols for breeding, migration and wintering populations; and the estimation population vital rates and attributes. Underlying these activities is a recognized need to understand avian life histories as shaped through biological interactions and influenced by management interventions. It is the contribution an improved understanding of life histories can make in

conserving and managing resources that ultimately motivates the necessary research and monitoring.

Habitat and environmental factors affecting avian populations and communities. In this category are included environmental and habitat monitoring, assessment of factors (e.g., hydrology, climate, wildlife disease) influencing avian abundance and distribution, remote sensing and field methods to collect data at appropriate spatial and temporal scales, and methods for recognizing habitat attributes and features affecting population dynamics. Motivating these efforts is a recognition that conservation is more effective when the role of the environment is factored into reproduction, mortality, dispersion and other biological processes.

Integration of ecological information into conservation models. The focus of research here is the modeling of factors, such as density dependence and environmental influences on population growth, the development of projection models characterizing population and community dynamics, and methods for visualizing and analyzing complex system behaviors. An implicit assumption here is that integrating biological, physical and ecological information into dynamic models promotes more effective assessment of avian populations and communities.

Strengthening the biological foundations of bird conservation planning. Needs identified here include the identification of goals for population and habitat conservation, assessment of biological assumptions in conservation planning, development of methods to integrate goals and identify joint interventions among conflicting conservation plans, and designs to handle variation in spatial, temporal, and ecological scales. A number of conservation plans, most notably the North American Waterfowl Management Plan, recognize the importance of improving their biological foundations so as to promote more effective conservation planning.

Communication of ecological information in support of conservation efforts. These needs include development of a distributed information network for linking and sharing information, development of applications tools for decision support that includes summarization and display of data as well as user-friendly models to explore the impacts of interventions, and development of methods and protocols to track learning to improve conservation over time. Managing and sharing information have been identified by many conservation partners as priorities, in large part, because of the extensive corpus of information that has already been acquired, but it is not readily accessible to those who need it.

Discussion

The list of needs identified previously is clearly not comprehensive, nor is it intended to be. Indeed, the list omits far more than it mentions. For example, it does not include such important topics as ecological genetics, patterns of natural selection, biogeographic theory and modeling, systematics, and many interesting and important research topics in theoretical ecology. No claims are made here about the intrinsic value of any of the latter areas of inquiry, and a different group of biologists with different interests and needs might identify a quite different list of priority information needs. Thus, ornithologists interested in species distributions might focus much more intensively on monitoring methods and protocols. Ecologists interested in species interactions, such as competition and predation, might focus on mechanisms of organism interaction and avoidance. Taxonomists might restrict their attention to methods of identifying species and discriminating among them. As in all human activities, the use of limited resources is (or ought to be) guided by intended purposes and goals. Here the purpose of the information is for conservation and management, recognizing that other areas of research, besides those above, can contribute indirectly to these ends.

The agenda presupposes that science and conservation are linked adaptively, in that both activities are mutually supportive components of the same enterprise. Thus, conservation is promoted through improved biological understanding, and understanding is, in turn, promoted through scientific investigation. It is the value added to conservation that ultimately justifies collection, assessment and sharing of biological information, and it motivates the inclusion of these activities in conservation programs.

There are several implications of this research agenda. One is that research should focus on the reduction of uncertainty in biological processes that are important in conservation. In particular, uncertainty should be recognized as a factor in assessing conservation options, and its reduction should be factored into the objectives of management. Second, monitoring programs must be designed (or redesigned) to facilitate understanding for use in conservation. This is in rather sharp contrast to the all too common practice of monitoring for its own sake (Holling 1995). Third, differences in scale between local habitat conservation on the one hand and regional habitat use by birds on the other means that issues of scale, whether across species, across habitats, across time or even across conservation groups, will continue to be important in both assessment and

implementation. Finally, research on ways to enhance and expand cooperative decision making should continue. It is broadly recognized that buy-in and cooperation are strengthened through communication and outreach, through involvement of partners in the decision making process and through incorporation of shared values in conservation goals and objectives (Lee 1993, Westley 1995, Williams 2003). However, many approaches to cooperative decision making can be envisioned, and it is less than certain which can yield the greatest benefit in a given set of circumstances. Investment in social research to address these important issues can have real conservation payoffs over the long term.

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Advancing Bird Conservation in a Way That Serves Broader Wildlife Conservation Needs: A State Agency's Perspective

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Introduction

This special session of the 68th North American Wildlife and Natural Resources Conference addresses the question of whether bird conservation can serve broader conservation needs and, if so, how those needs can best be met. My focus will be on the role of state wildlife agencies in this process. Our challenge is to identify the components of a bird conservation program that will conserve a wide array of wildlife species and to offer some suggestions to help such a program become a reality.

The first question is whether or not bird conservation can serve the needs of a wider array of wildlife, and, as proof of this possibility, I offer an example from the Southeast. A long-established system of private wildlife preserves in southwestern Georgia provides clear evidence that bird conservation can effectively provide for the needs of an entire community of wildlife. Long before all-bird or ecosystem management was conceived, the hunting plantations of southwestern Georgia were practicing it. With the primary objective of producing

northern bobwhite (*Colinus virginianus*) for recreational hunting, this traditional system of habitat management has maintained the largest population of the endangered red-cockaded woodpecker (*Picoides borealis*) on privately owned lands, and it has maintained two of the best examples of old growth longleaf pine (*Pinus palustris*) forest left in the world (Engstrom and Baker 1995). Known as the Red Hills, these plantations were originally purchased by wealthy northern industrialists as recreational retreats following the Civil War (Bruckheimer 1988). Forest management practices, developed by Herbert Stoddard Sr. and W. Leon Neel, produced populations of quail capable of supporting hunting for owners and their guests in an aesthetically pleasing landscape. With the range of longleaf pine reduced from its former expanse of 90 million acres to less than 3 million acres (Franklin 1997), the remnant forest of mature, frequently burned pine in the Red Hills is a rarity, particularly on private lands. While quail populations have plummeted throughout the Southeast, they have remained stable or even increased on these managed plantations (Brennan et al. 2000). This management system succeeded in maintaining an entire ecosystem and benefitting not only the targeted prince of game birds but also a diverse assemblage of wildlife species, including the red-cockaded woodpecker, Bachman's sparrow (*Aimophila aestivalis*), gopher tortoise (*Gopherus polyphemus*), Florida pine snake (*Pituophis melanoleucus*), fox squirrel (*Sciurus niger*) and pocket gopher (*Geomys pinetis*) (Engstrom and Baker 1995).

This example of bird conservation includes the elements necessary for any effective conservation program. These elements include:

- a clear objective
- a sound understanding of the biology of the species and the factors limiting that species
- adequate funding to implement the program
- implementation at the appropriate scale
- an effective method to monitor success.

First, this conservation effort included a clear objective: to produce high populations of northern bobwhite quail in an aesthetically pleasing landscape. Second, a solid, scientific foundation for management of this species was available. Herbert Stoddard's long-term research on northern bobwhite produced the first detailed monograph of the ecology of a species (Stoddard

1931). This seminal work has guided decades of habitat management for the northern bobwhite as well as serving as a model for other species. Third, the management practices needed to produce quail were adequately funded. Financed by wealthy northern executives as hunting retreats, plantation managers had virtually unlimited resources to implement the necessary habitat management. Fourth, this habitat management was applied at a scale that was significant at the landscape level. Although each plantation was quite large, it was the combined area of the plantations that maintained a functioning longleaf ecosystem. We must implement conservation strategies at appropriate scales without restrictions based on political or agency boundaries or traditions. Last, the success of the program was rigorously evaluated every time the plantation owner hunted. Coveys per hour hunted served as a standard by which owners compared their success.

This example is only one of many in which bird species conservationists have led the way for conservation of a broader array of wildlife. Bird conservation successes with far reaching conservation benefits are well represented in the history of wildlife management. Waterfowl have carried the banner for bottomland forest restoration in the Mississippi Valley; the bald eagle (*Haliaeetus leucocephalus*) has been the rallying point and symbol of success for endangered species recovery; the decimation of wading birds for the plume industry led to the formation of the National Wildlife Refuge System in the United States; Rachel Carson's book, *Silent Spring*, began the modern environmental movement. With the completion or near completion of plans for every major bird group, including waterfowl, shorebirds, wading birds, land birds and many game birds, the stage is set for significant progress in bird conservation throughout North America. The challenge facing the wildlife community is to identify and provide the key resources needed to move bird conservation forward and expand its coverage to other wildlife groups and species.

Primary Needs

If we accept that bird conservation can serve a broad array of conservation needs, what is needed at the state level for this to be achieved? First, clear objectives and good information on which to base management are critical. We need to determine the status of many species and habitats and to understand factors limiting species if we wish to make conservation improvements.

Significant progress has been made in recent years to identify, at the national level, species and habitat priorities for migrant land birds, shorebirds, wading birds and waterfowl (Carter et al. 2000). But significant gaps exist in our knowledge of species biology, habitat requirements, and methods to conserve many species of birds and other wildlife. Substantial investments will be necessary to address these needs. Other panelists will cover research and monitoring so I won't go into detail except to say that sound biological information will be critical for any successful conservation program. Likewise, implementation at the appropriate scale and a clear monitoring program will be necessary to achieve conservation of birds and other wildlife.

Good information alone, however, is not enough. To implement far-reaching conservation actions, we must have sufficient funding to implement conservation programs, and that funding will require political support. To increase our political support, we will need to undergo significant cultural change in our state agencies. From my viewpoint and experience, these three interrelated issues are the most critical issues facing state wildlife agencies as they expand their conservation focus. Success in addressing these issues will result in the resources and support that will allow conservation of all birds as well as other wildlife species. Failure will lead to continuing declines in populations of many species. As the most critical issues identified for state wildlife agencies, my presentation will focus on these needs and how we may address them.

Funding

The need for additional funding for the conservation of birds and other nongame wildlife has long been recognized. When I became Director of the Georgia Game and Fish Division in 1991, I convened a group from throughout our division to identify priorities and needs. This effort identified funding for nongame wildlife as one of the greatest needs for our agency. Since that time, I have devoted considerable effort to securing adequate funding for conservation of nongame wildlife. At the state level, we developed a nongame wildlife conservation auto tag that has sold over 840,000 plates and raised over \$13 million for conservation. Although inadequate to fully address the conservation needs of nongame wildlife, the funding from the tag has allowed us to significantly expand conservation efforts. At the national level, I have had the opportunity to work with the International Association of Fish and Wildlife Agencies (IAFWA) to secure

increased federal funding for fish and wildlife conservation. We were not successful in passing the Conservation and Reinvestment Act (CARA), but funding to states, through the Wildlife Conservation and Restoration Program and the State Wildlife Grants Program, has significantly increased the opportunity for wildlife conservation in our state and in many others. But, as much as these programs are needed, they cannot support the long-term conservation that CARA would have funded.

One of the reasons that CARA failed was lack of support from national conservation organizations. We, particularly state agencies, had not fully gained the trust of that very diverse contingent of nonhunting organizations and people. We must continue to develop those relationships. And, these groups must also become more involved in and knowledgeable of the challenges faced by agencies.

Political Support

Federal and State wildlife agencies exist in political environments. Within these often volatile environments, agencies charged with the stewardship of our wildlife resources have set the standard for wildlife conservation for the rest of the world. A large part of this success is inexorably linked to the political support offered wildlife programs.

Most wildlife agencies were forged in the first half of the past century because North Americans were concerned about dwindling populations of wildlife, particularly big game. Although funds were scarce, politicians recognized that their constituents, particularly hunters and fishers, supported the development of programs that would preserve, protect and better manage dwindling wildlife and fish populations. Political support was deep enough to finance these efforts with license fees and excise taxes, created through the passage of the Pittman-Robertson Act and Dingell-Johnson Act. Consequently, our agencies principally reflected the interests of sportsmen and sportswomen.

As we all know, our constituency is rapidly changing and becoming more diverse. In addition to hunters and fishers, our agencies now also represent bird watchers, outdoor recreationists, wildlife photographers, native plant enthusiasts and many others concerned about the environment and the wild plants and animals it supports. While the broadening of our mission is a positive step, most wildlife agencies are having a difficult time funding songbird and other nongame

wildlife initiatives. Although interest in animals that are not hunted, fished or trapped is strong, there is a paucity of funds available to finance sustained programs to address the needs of this diverse group of animals.

This is somewhat surprising, given the popularity of wildlife watching. In 2001, 66 million U.S. citizens participated in some type of wildlife watching activity, including observing, feeding or photographing wildlife. Those millions of wildlife watchers spent \$38 billion on trips, equipment and other items. The number of U.S. citizens that hunted and fished in 2001 was 13 million and 34 million, respectively (U.S. Fish and Wildlife Service 2002). Given the substantial political clout and support of sportsmen and sportswomen, we must bring to bear the political strength of this even larger body of wildlife watchers, many of whom feed and watch birds. Even allowing for overlap in wildlife watching and hunting or fishing, a large segment of wildlife enthusiasts must become actively engaged in support of wildlife conservation.

Our recent experience of trying to create a dependable funding mechanism for songbird and other nongame wildlife conservation has demonstrated that we have yet to sufficiently convince conservationists, our elected officials and even some conservation organizations of this need. The key to the passage of this legislation is galvanizing political support. To accomplish this we must intensify our efforts to sensitize both the public and our elected officials of the plight of nongame wildlife. We must also convince hunters and fishers that nongame conservation initiatives will benefit them. Given their strong popularity with the public, birds, particularly Neotropical migrants, can provide an introduction to the conservation needs of numerous, less charismatic wildlife species.

Culture Change

In order to examine the cultural changes needed for comprehensive wildlife conservation, we must first understand the origins of that culture. Wildlife conservation had its beginnings in hunting and fishing and the earliest conservationists were hunters and fishers. The first private organization to deal effectively with conservation issues was the Boone and Crockett Club, founded by prominent hunters, like Theodore Roosevelt and George Bird Grinnell, and named after two of North America's most famous hunters (Reiger 2001). If not for these progenitors, our wildlife legacy would be only a fraction of its current

quantity and diversity. Hunters and fishers have continued to be active conservationists by supplying most of the funding for wildlife conservation through license fees and the Pittman-Robertson, Dingell-Johnson, and Wallop-Breaux contributions. Hunting, fishing and the management of game species are our roots and our primary cultural influence. Now, we must grow from those roots to embrace the full array of wildlife species.

To a large extent, both state and federal agencies reflect our origins, and much of the culture of these agencies is focused on species that are hunted or fished. This emphasis is also evident in our traditional stakeholders, such as Ducks Unlimited, Inc. (DU), National Wild Turkey Federation, Quail Unlimited and Ruffed Grouse Society. In our efforts to pass the CARA legislation, we began to develop new supporters, but those relationships are still in their infancy.

Until recently, with the exception of a handful of endangered species, most of our research and management was focused on game species. We have made substantial progress in learning more about the ecology and conservation needs of the many species of wildlife that are not hunted and fished. But, we still have much to do to meet those needs. In most states, staffing is inadequate to address the numerous groups and species of nongame wildlife. However, adding a handful of nongame specialists will not fully diversify wildlife management programs. We will likely never have sufficient financial or habitat resources to address game and nongame species conservation separately, and such a dichotomous system would be counter-productive. The better approach is to augment agencies with the expertise necessary to identify and design conservation strategies for nongame species. Those individuals must be integrated and accepted into existing cultures to accomplish conservation of all wildlife, including birds and the other taxonomic groups.

The responsibility for making this work does not lie solely with the nongame proponents. Existing agency cultures must accept a more holistic view of wildlife management. Cultural change will be necessary at every level and will require both guidance from the top as well as training and practice at the field level. It will not be fast, and it will require commitment and strong leadership over the long haul. Cultural change does not mean that everyone's job will change or that employees will be expected to do more with the same resources, nor will we abandon those practices and constituencies that have brought us so much success. We must change the philosophical outlook of agencies and constituencies to accept the merit and necessity of addressing the conservation

of all wildlife species. Once that outlook has changed, we can then address duties as conservation priorities dictate. Difficult decisions and choices will be necessary because we will not be able to manage for every species on every acre. However, with the appropriate consideration, priorities can be set and followed through for the desired result of effective conservation.

Another aspect of agency culture that must evolve to meet the needs of our all-bird and all-wildlife conservation is that of scale. We cannot be content to consider only issues or actions within our own boundaries, whether those boundaries define a state, national wildlife refuge, national forest, or wildlife management area. The challenges we face from expanding human populations, land development, intensive agriculture, industrial growth and other forces are too great to face individually. Migratory birds are perhaps the most obvious example of species with wide-ranging considerations, but large-scale efforts are also needed to address conservation of numerous other animals, from bears to bison. Biologists and land managers with the ability to influence and implement conservation practices also must have support to be engaged in regional and national discussions of planning, prioritization and conservation design.

A cultural evolution of this magnitude will require a substantial commitment to outreach and education—both within our agencies and traditional partner organizations and to new stakeholders and constituents. Within agencies, support for this new agency culture must be conveyed from the top down and supported at every level. In addition to maintaining relationships with traditional stakeholders through involvement and information exchange, we must further develop the same type of trust and rapport with additional groups. Staff must be as comfortable contacting, meeting, presenting to or working with Audubon Society chapters and The Nature Conservancy as they are with DU, Pheasants Forever or the Rocky Mountain Elk Foundation. Frequent and accurate information exchange will be critical to developing and maintaining these vital working relationships.

Now, before heads start to shake and doubts creep in, consider how this type of cultural change is already occurring and is fostered by bird conservation. Bird conservation regions (BCRs), the geographic context for the North American Bird Conservation Initiative (NABCI), were not developed by a federal agency or a geographical information systems laboratory to be imposed onto conservation planning efforts. BCRs were developed cooperatively by the authors and leaders of the North American Waterfowl Management Plan,

Partners in Flight (PIF) bird conservation plans, the U.S. Shorebird Conservation Plan and the North American Waterbird Conservation Plan. This BCR scheme was also utilized by the Northern Bobwhite Conservation Initiative and is being followed by other upland game bird planning efforts, providing a common reference for planning and implementing bird conservation across game, nongame, upland and wetland birds. In addition, the U.S. steering committee for NABCI includes representatives from state and federal government, the four migratory bird initiatives, the National Flyway Council, the Wildlife Management Institute, DU, American Bird Conservancy, the Resident Game Bird Working Group and other diverse bird interests.

Partners in Reptile and Amphibian Conservation (PARC) followed the conservation model of PIF and invited many long-term PIF leaders to be involved in the initial meetings to develop and launch PARC. Both PARC and the North American Bat Conservation Partnership have open dialogues and frequent exchange with the PIF network at the local, regional and national scale. The Lower Mississippi Valley Joint Venture, a partnership with its origins and funding secured in the North American Waterfowl Management Plan, has been the catalyst for habitat restoration at an unprecedented scale. In addition to waterfowl and numerous migratory birds, one of the principle species considered in the conservation design of the Lower Mississippi Valley has been the Louisiana Black Bear (*Ursus americanus*). Thus, the lines between taxonomic groups are already quite blurred as wildlife conservation activities are implemented.

Longstanding conservation partners, such as DU, also have substantially broadened their scope. DU now employs a shorebird and wetland bird specialist who is an active participant and major contributor to PIF, waterbird and shorebird planning efforts. Without weakening its commitment to waterfowl, DU has strengthened its ability to conserve vital wetland habitats by diversifying its expertise. Many of our industry partners have expanded their focus as well. In addition to providing substantial resource benefits through traditional hunting lease programs, corporate landowners routinely identify and protect rookeries and other important nesting sites, and they identify and manage species and habitats of concern. In Georgia, swallow-tailed kite (*Elanoides forficatus*) nest locations are incorporated into management databases and considered in management prescriptions and actions. Many companies either independently or cooperatively sponsor long-term, landscape scale research into wildlife responses to various land management techniques. Some corporate landowners

train their employees to take part in bird monitoring programs, such as point counts for breeding season assessments or migration monitoring. Within state and federal agencies, biologists whose job duties once only included white-tailed deer (*Odocoileus virginianus*) hunts and data collection, wild turkey (*Meleagris galapavo*) restoration and bear harvest analysis and population surveys, now conduct point counts for spring songbird surveys or migration monitoring routes. Wildlife technicians who burn pine forests to enhance habitats for turkey or quail also burn seasonal ponds for gopher frogs (*Rana areolata*) or native prairies for rare wildflowers. Water levels are manipulated to provide winter foraging areas for waterfowl as well as exposed mudflats for stopover by migrating shorebirds.

The challenges of this cultural evolution—or revolution if you prefer—are many, but the signs are promising with bird conservation providing excellent examples of how to proceed. With careful planning we can continue to expand our conservation efforts while maintaining the programs that have been so successful.

Implementing Bird Conservation

Currently, state agencies are developing comprehensive wildlife conservation strategies as a requirement for eligibility for federal funding. Every state that seeks funding through the State Wildlife Grants Program commits to developing a comprehensive wildlife conservation strategy by October 1, 2005. All the states have applied for that funding. The development and implementation of these plans offers an excellent vehicle and opportunity to advance not only bird conservation, but conservation of all wildlife.

Over the next two months, the U.S. Fish and Wildlife Service and the IAFWA will be hosting a series of workshops around the country to assist states in developing these plans. It will focus on the state plans acting as a vehicle to address the needs of all birds as well as other wildlife. These plans, if developed in cooperation with other state and federal agencies and conservation organizations, offer the best opportunity to expand conservation for all birds and all wildlife. Guidelines for the plans call for public input and for cooperation with other agencies in development of the state plans. The plans offer an excellent opportunity to step-down the appropriate portions of national plans, such as the North American Waterfowl Management Plan, PIF plans, Shorebird Plan and Waterbird Plan, as well as to incorporate other information from other

conservation planning efforts, such as the ecoregion plans developed by The Nature Conservancy. With proper consideration in their development, these state plans can support and strengthen a wide range of conservation programs, including the Farm Bill, state and federal land acquisition programs, and other wildlife conservation efforts. Cooperative efforts will be essential to conserve the full array of wildlife and the habitats they require. Indeed, partnerships and cooperative projects are the only feasible approach to addressing the needs of all wildlife.

Outstanding examples of partnership-based projects have demonstrated the effectiveness of this approach, from the ACE Basin (the confluence of the Ashepoo, Combahee and Edisto rivers), in South Carolina, to the Mississippi Alluvial Valley. State plans offer the potential to identify opportunities for cooperation throughout the country. But, this won't happen by accident. It will require leadership and commitment from state wildlife agencies. The opportunity is present to reach out to new constituencies while continuing to work with the traditional groups who have long supported wildlife conservation. I challenge each state director to support development of sound collaborative conservation plans for their state that addresses all wildlife species in need of conservation.

The first step is to send appropriate staff to the training workshops. These will offer an outstanding opportunity to compare strategies and to learn about approaches that have worked in other areas. Second, reach out to all of the agencies and organizations in your state that have information or experience in conservation planning and implementation of conservation programs. Natural heritage programs have a wealth of information that will be critical to an effective plan. If a heritage program in your state is not within your agency, then arrange to work with them on the process. Finally, the development of the plans needs to include significant opportunity for public input throughout the process. Not only will this input strengthen the planning process, but public involvement can also build the relationships with diverse conservation organizations and garner much needed political support.

Conclusion

The annals of wildlife conservation are filled with success stories. During the past century we have developed the world's best wildlife conservation programs. Wild turkey and white-tailed deer populations are at all time highs.

Waterfowl numbers are on the rise, and many populations have reached the goals of the North American Waterfowl Management Plan. The bald eagle and peregrine falcon (*Falco peregrinus*) have been brought back from the brink of extinction with accompanying changes in their status as endangered species. Millions of acres of federal and state lands are managed for wildlife and provide the untold, wildlife-based, recreational opportunities. Notably, in 2003, we celebrate the 100th anniversary of our National Wildlife Refuge System.

Over the decades, North Americans have responded to every conservation challenge that we have faced. Arguably the plight of Neotropical migratory birds and other nongame wildlife poses our greatest challenge yet. If we are to solve this problem, we will need the combined talents of administrators, biologists, governmental leaders, nongovernmental organizations, educators and others. We can make it happen if—and this is a big if—we can generate the political support of the public for conservation of all wildlife. Our success in garnering this support will ultimately determine our ability to conserve our wildlife legacy.

Comprehensive state wildlife conservation strategies offer an excellent vehicle to forge the support that will be needed for wildlife conservation in the United States. By reaching out to others, we can develop and maintain the support necessary to implement conservation of all birds and all wildlife.

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Birds and Conservation Accounting

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Introduction

Birds are excellent indicators of ecosystem health. Sensitive barometers of environmental change, birds alert humans to current and future threats, such as global climate change and dichlorodiphenyl trichloroethane (DDT). Birds are the “canaries in the coal mine” because they are high on the food chain, ubiquitous and relatively easy to study.

Birds have even more to offer. As conservation funds become scarcer, government agencies, foundations and private interests that devote enormous resources to conservation are asking: “How do we know if our investments are paying off?” Bird studies can answer this question by providing a cost-effective means of auditing conservation investments.

From restoring wetlands to managing fisheries, bird science provides insights to help assess and promote effective wildlife and habitat management actions that support fully functioning ecosystems to sustain the greatest diversity and abundance of birds and other wildlife.

Conserving biodiversity is a hugely complex task. While we can proudly count hectares protected, we have difficulty measuring biological success and often lack the most basic data on which to base management and planning decisions.

This paper highlights how PRBO Conservation Science (PRBO), founded as Point Reyes Bird Observatory in 1965, is applying bird science in an ecosystem context to conserve the diversity and abundance of wildlife across the West. The following examples demonstrate why birds are among the best conservation auditors.

Background

PRBO Conservation Science works throughout the West in terrestrial, wetland and marine ecosystems. Our 120 staff and seasonal biologists study bird populations and their ecosystems to understand, protect and enhance biodiversity.

Regionally and nationally, PRBO is an active leader in Partners in Flight, the U.S. Shorebird Conservation Plan, the North American Waterbird Conservation Plan and the North American Waterfowl Management Plan's regional joint ventures. We cochair California Partners in Flight, chair the Southern Pacific Shorebird Planning Region, serve as vice chair of the San Francisco Bay Joint Venture and cofounded the Riparian Habitat Joint Venture in California.

PRBO collaborates with governmental, nongovernmental and nontraditional partners, such as private landowners and fisheries interests. We were honored with the national Conservation Partner Award from the U.S. Department of Agriculture Forest Service and the U.S. Bureau of Land Management in 2002.

Adaptive Conservation Planning

Threats to biodiversity are increasing rapidly in the West, yet billions of dollars are invested in ecosystem restoration and management without ongoing scientific guidance and evaluation. It is imperative that managers continually ask—and answer—the question: “Are our efforts improving wildlife values?” If this question is not regularly addressed, then well-intentioned conservationists may not only waste scarce funds but may inadvertently contribute to wildlife and ecosystem decline.

Studying suites of bird species, those whose needs represent a broad range of habitat characteristics, can provide that accounting for conservation to help managers learn and be more successful in conserving birds and other elements of the ecosystem. A landscape designed to meet the needs of the focal species whose requirements represent a spectrum of habitat characteristics can encompass the needs of other species (Lambeck 1997).

Adaptive management, critical to conservation success, involves treating management as a continual experiment in which the results of previous actions are evaluated and the findings are used to modify future management (Holling 1978, Ringold et al. 1996). PRBO's Adaptive Conservation Planning Process is a science-based, continuous feedback loop. It emphasizes the ongoing, scientific evaluation, analysis and feedback that are sometimes lacking in management practice but that are essential to ensuring that conservation measures enhance biodiversity. Each step involves engaging numerous partners, including scientific, governmental, nongovernmental and private collaborators.

In addition, adaptive conservation planning requires standardized monitoring methodology applied across landscapes. PRBO coauthored the *Handbook of Field Methods for Monitoring Landbirds* (Ralph et al. 1993), which was developed, in part, from our long-term landbird studies at Palomarin Field Station at Point Reyes National Seashore. Published in English and in Spanish, it is now in use throughout North America and in many Latin American countries. PRBO is also coauthor of a new monitoring and census techniques manual for waterbirds (Steinkamp et al. 2003). Standardized monitoring is essential to the apples to apples analysis of data, over time and across sites (locally, regionally and continentally). Standardized monitoring provides the basis for evaluating and guiding management actions to conserve wildlife populations.

Adaptive conservation planning, with its science-based, continuous, feedback loop and its standardized processes, is akin to having regular financial statements prepared according to generally accepted accounting principles (GAAP), the accounting principles, standards and procedures that all corporations in the United States are expected to follow. Financial statements, prepared according to GAAP provide a tool for investors and independent interests to evaluate and improve corporate, bottom-line performance. Similarly, adaptive conservation planning allows scientists, wildlife and habitat managers, policy makers, private interests and the public to assess whether investments in conservation are improving the bottom line for wildlife.

While some downplay the value of adaptive management, investors would flee from a corporation that did not provide regular, standardized measures of performance! The same should be true for our conservation investments. Conservation accounting, i.e., regularly assessing species and ecosystems, so management actions can be revised accordingly, has enormous economic, social and biological implications. We would be irresponsible investors if we did not ensure that ecosystem “financials” were regularly produced and rigorously reviewed. With that information, we can best determine how to improve management practices to get the most biodiversity bang for each conservation buck invested. Birds help us to do just that.

Riparian Birds and Conservation Accounting

How has adaptive conservation planning for birds improved resource managers’ actions? Following are two examples, based on PRBO’s riparian (streamside) habitat studies in the Central Valley of California.

The loss of riparian habitat was identified as perhaps the most important cause of landbird population decline in western North America (DeSante and George 1994). Before PRBO and others began working to help guide riparian acquisition and restoration in Central Valley in the mid-1990s, large investments were made in restoration projects that did little to improve the status of many bird populations. Well-intentioned restorationists planted cottonwood trees in the areas best suited for grassland and riparian scrub. PRBO research confirmed that failure to restore the understory was detrimental to bird species diversity because more than 50 percent of riparian songbirds nest between the ground and 6 meters off the ground. In fact, none of the selected riparian focal bird species utilized the restored site. These focal species, including common and uncommon species, were selected through a consensus of experts based on the birds' preferences that defined different spatial attributes, habitat characteristics and management regimes that were representative of a healthy system (Chase and Geupel 2002).

Similarly, certain land acquisition and restoration projects were driven by the assumed needs of a single, threatened species, the Yellow-billed Cuckoo (*Coccyzus americanus*), and focused primarily on old growth riparian forests. However, the vast majority of California's riparian species (including cuckoos, which rely on the nearby oak woodland as well as riparian habitat) depend upon diverse structure (not just large trees) as well as a broad mosaic of habitat types. In the past, focal species were often selected because of their threatened or endangered status, but the species that are at the greatest risk are not necessarily the most effective focal species (Franklin 1993)

Without regular scientific evaluation and interpretation, restoration efforts can inadvertently undermine our common goal of increased wildlife abundance and diversity. In these cases, studies of several common as well as threatened focal bird species were conducted by PRBO to help habitat resource managers learn what worked well and what did not. Resource managers then adapted their approach based on PRBO's feedback to significantly enhance their conservation efforts.

Birds are indicators of riparian habitat quality because they are sensitive to a variety of physical and biological factors, including levels of primary and secondary productivity in the system, the structural and species diversity of vegetation, and the size and connectivity of habitat patches (Griggs and Small 2000). In addition, bird numbers have responded quickly and positively to some, but not all, habitat restoration efforts. Thus, bird population health is both a

conservation goal, in itself, and an indicator of the success of riparian habitat management and restoration.

PRBO recently received a grant from the California Bay-Delta Authority (CALFED) to analyze Central Valley riparian bird data across distinct spatial scales to further develop and refine the use of birds as ecosystem indicators. The CALFED Bay-Delta Program, one of the largest, single, ecosystem restoration programs in the history of the United States (second only to the Everglades effort), is a consortium of 23 state and federal agencies (CALFED agencies) that works to improve water supplies in California and the health of the San Francisco Bay-Delta watershed. The Bay-Delta watershed, “provides drinking water for 22 million people. . . . [It is] the largest estuary on the west coast—home to 750 plant and animal species—and it supports 80% of the state’s commercial salmon fisheries.”

One of CALFED’s top implementation priorities is to, “apply independent scientific review and adaptive management to all major activities with accurate and frequent reports to the public” (CALFED 2002). Birds will play a significant role in evaluating and guiding future restoration investments.

Landbirds and Fish: Enhancing Riparian Ecosystem Function

How has adaptive conservation planning for birds helped fish populations? The Nature Conservancy, in partnership with the U.S. Bureau of Land Management, California Department of Fish and Game, Ducks Unlimited, Inc., and others, manages the Cosumnes River Preserve (Cosumnes) in the Central Valley.

An accidental levee break in 1986 resulted in a new riparian forest at the site. PRBO’s studies demonstrated that this “accidental forest” harbored one of the highest breeding songbird diversities in the Central Valley. These findings led to a series of recommendations for riparian habitat restoration (Riparian Habitat Joint Venture 2000) that promote the use of natural processes, such as flooding, and the planting of restored sites in patches to mimic habitat structures that result from flooding.

Habitat created since then to help neotropical migratory birds at Cosumnes, and elsewhere in the Central Valley (based on recommendations from PRBO’s research there), has now been observed to be important for native anadromous fishes, including special-status species like chinook salmon (*Oncorhynchus tshawytscha*) and Sacramento splittail (*Pogonichthys*

macrolepidotus). Freshwater streams and estuaries provide important habitat for feeding on terrestrial and aquatic insects, amphipods, and other young crustaceans.

Researcher Ted Grosholz, of the University of California at Davis, recently found significantly higher densities of aquatic invertebrates (insects, snails and worms) in forested habitats compared to open areas on the floodplain (where it had been expected to have higher invertebrate biomass due to higher levels of solar radiation entering the water). Differences were probably due to higher levels of nutrients being available in the forest where detritus is more prevalent and dissolved organic carbon is several times higher.

While these invertebrates provide important fish food, fish typically do not venture into the forest areas as the dissolved oxygen levels are too low. Yet, there can be great flushing of fish prey from these habitats during flooding. Having forested and open habitats in close proximity appears to be extremely beneficial to native fish that often rear on the open floodplain habitats (Golet, personal communication 2003).

Thus, by auditing the initial accidental levee break using birds, management recommendations were developed that have dramatically improved the ecosystem's value for birds as well as other wildlife.

Seabirds as Indicators

Applying bird studies to conservation accounting works well in marine ecosystems as well. Seabirds are valuable for identifying and protecting pelagic food webs because they are numerous and conspicuous marine predators, they respond to changing water mass distributions and ocean productivity patterns, and they feed on many of the same prey as other top level marine predators, including large fish, sea turtles, seals, sea lions and whales (Hyrenbach et al. 2002).

PRBO's Marine Ecology Division has been collaborating with fisheries biologists from various agencies to apply seabird information towards understanding at-sea fish ecology and to help enhance fisheries management.

The factors that affect the feeding conditions of fish are not well-known, and direct measurements of fish food abundance and availability are difficult to obtain. However, several fish species that spawn in central California have similar diets to seabirds, and the diet and reproductive success of seabirds are relatively easy to study.

Through a unique cooperative agreement with the U.S. Fish and Wildlife Service, PRBO biologists have stewarded the Farallon Islands (approximately 27 miles west of the Golden Gate Bridge) daily since 1968. PRBO's more than three decades of research there have resulted in some of the longest term-data sets on breeding seabirds and marine mammals in the northern hemisphere, revealing both human-caused and natural changes (from oil spills to climate change) in the marine ecosystem.

For example, PRBO researchers found that productivity of common murre (*Uria aalge*), western gulls (*Larus occidentalis*), and Cassin's auklets (*Ptychoramphus aleuticus*)—the planktivorous seabirds that feed on the same prey and at the same trophic level as Pacific herring (*Clupea pallasii*) in their prespawning, oceanic life stage—is correlated with spawning biomass and body condition of the herring in San Francisco Bay the following winter.

Fisheries managers currently use adult spawning population biomass and age composition from the prior season, as well as information on ocean conditions and young-of-the-year abundance to assess the status of the herring population and establish harvest quotas. However, spawning biomass in year x may not accurately predict stock size in year $x + 1$ if variable oceanographic conditions affect at-sea herring foraging and survival, particularly for the new recruits to the spawning population (ages 2 and 3). Seabird productivity data can provide novel information on oceanic factors affecting herring life history, which may enable more accurate forecasts of spawning biomass and other critical fishery statistics for more effective management.

Three of our Farallon Island seabird study species, specifically pigeon guillemots (*cepphus columba*), rhinoceros auklets (*cerorhinca monocerata*) and common murre, feed on fish (are piscivorous seabirds) and have similar prey to chinook salmon (*Oncorhynchus tshawytscha*), including juvenile rockfish (*sebastes* spp.), during the breeding season. Seabird diet information can be combined with estimates of pelagic juvenile rockfish abundance from National Marine Fisheries Service trawls (1983–2002) to develop multivariate rockfish index (MVI) abundance. Our results suggest that the MRI could help fisheries biologists and managers assess past variability in juvenile rockfish abundance and predict future abundance in central California.

Seabirds can provide key data for auditing marine ecosystems to improve ocean management and benefit commercial fisheries, seabirds and other wildlife dependent upon complex marine food webs.

Birds and San Francisco Bay

San Francisco Bay is one of the most important estuaries for birds in North America and is a critical link in the Pacific Flyway. PRBO's research has shown that millions of shorebirds and waterfowl use various San Francisco Bay habitats through the year, including human-made salt evaporation ponds, tidal flats and tidal marshes. These habitats are used as wintering grounds, as stopover, refueling areas during their annual migration, and for breeding.

Since the 19th century, approximately 83 percent of the San Francisco Bay's historic tidal marsh habitat has disappeared due to human activities, such as diking for agriculture and urban development. This habitat loss puts the long-term viability of wetland-dependent wildlife populations at risk, including birds, mammals and fish, and it undermines the vital role that a tidal marsh plays in filtering pollutants and maintaining water quality. Several species that depend on San Francisco Bay tidal marshes year-round are listed as endangered, threatened or of special concern.

While human development has drastically altered the ecosystem, the San Francisco Bay's importance as a wildlife habitat has only grown as other estuaries and wetlands have been reduced or eliminated in other parts of California and the Pacific Flyway.

Currently, there are significant efforts to protect what habitat remains and restore some of what was lost. Around the San Francisco Bay, approximately 28,000 acres have already been acquired, restored or enhanced, and there are plans for much more; these represent investments amounting to hundreds of millions of dollars. Restoration aims to reestablish natural ecosystem function, yet wetlands are extremely complex and their function is poorly understood. In addition, the science of restoration is in its infancy. It is critical that these investments are guided by a scientific understanding of habitat requirements and ecosystem function.

Bird studies are driving this effort. For example, birds play important ecological roles in marsh ecosystem function, serving as predators and prey, and they appear to be important in nutrient cycling, depositing important nutrients into productive marshes. PRBO's research on tidal marsh is elucidating key features associated with successfully breeding, marsh-dependent birds (including associated vegetation, channel size, patch size and adjacent habitat type) that will guide the design of restored marshes.

A diverse bird community of more than 125 species regularly relies on San Francisco Bay habitats. Their requirements overlap other organisms' requirements, including native invertebrates, fish and mammal populations. Using birds as indicators, PRBO is beginning to model how different habitat types support different species of birds and different densities of birds. With these models, we hope to predict how habitat restoration efforts will affect animal and plant populations. Ultimately, we hope to include data from other taxa, and information on sea level rise and other physical processes to ensure ecologically-sound restoration that maximizes biodiversity and abundance and that minimizes costs. Birds on San Francisco Bay are providing the data for regular financials, annual audits and long-term forecasts to best conserve biodiversity in this rich ecosystem.

Conclusion

Conservation accounting through bird studies is working to enhance habitat to the benefit of birds and other wildlife. Adaptive conservation action, based on regular, scientific feedback from standard monitoring of focal bird species and habitats is contributing significantly to effective ecosystem conservation in California and in the West.

Indeed, birds are excellent conservation accountants, helping to ensure that we get the most out of our conservation dollars to enhance biodiversity for generations to come and to advance the application of bird science in conservation. Further testing should be conducted on trophic function, energy flow, habitat fragmentation and effects of invasives.

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Meeting the Challenge: The Role of the U.S. Fish and Wildlife Service for Bird Conservation

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The early years of the 20th century formed a period of significant advancement in wildlife conservation. Responding to the alarming effects of overexploitation and habitat loss on wildlife populations—particularly birds—conservationists, such as Pinchot, Grinnell and Roosevelt, forwarded strong, lasting policies and programs. These landmark advances included the Lacey Act (1900), which prohibited interstate transport of birds killed in violation of state laws, the creation of Pelican Island (1903), the first federal wildlife refuge, for the protection of colonial waterbirds from plume hunters, and the Migratory Bird Treaty Act (1918), which obligated the United States to protect and preserve migratory birds.

The U.S. Fish and Wildlife Service (Service), established as the Bureau of Biological Survey in 1885, was assigned the unique and significant trust responsibility for maintaining healthy bird populations. The Service retains this responsibility, which involves population and habitat monitoring and assessment, population and habitat conservation and management, national and international coordination and communication, and administration of permits and regulations. The Service's Migratory Bird Program serves as the focal point for these activities.

The Service's vision for migratory bird management and conservation is that migratory bird populations and their habitats are conserved and managed at levels that recognize their continued ecological significance while providing opportunities for human use and enjoyment. Nearly 79 million adult residents in the United States (37% of the adult population) participate in wildlife-related activities, and 88 percent of them pursue activities that focus specifically on migratory birds (including hunting and bird watching). Each year, these people

contribute nearly \$60 billion dollars to the U.S. economy for expenses related directly to these wildlife-related pursuits.

Furthermore, expectations by this segment of North Americans are that these recreational opportunities and first-hand experiences with migratory birds in their natural habitats will remain available for their children, grandchildren and great-grandchildren (U.S. Fish and Wildlife Service 2002). The Service's vision for migratory bird conservation and management, therefore, calls for appropriate population levels that are driven not only by ecological importance but also by cultural desires and socioeconomic factors. Only in extreme and irreversible cases should we be satisfied with maintaining bird populations in a minimum viable state.

This vision is closely aligned to the vision of bird conservation plans. The Migratory Bird Program serves as a focal point for policy development and strategic planning that advances bird conservation through the implementation of comprehensive bird management plans. Those plans that are critical to the Migratory Bird Program are the North American Waterfowl Management Plan (U.S. Fish and Wildlife Service 1998), Partners in Flight (Pashley et al. 2000), the U.S. Shorebird Conservation Plan (Brown et al. 2001), the North American Waterbird Conservation Plan (Kushlan et al. 2002), and the migratory game bird management plans developed by Flyway Councils (see Hawkins et al. 1984).

Bird conservation plans have been developed by coalitions of federal and state agencies, tribal entities, foreign governments, nongovernment organizations, industry, academia and private individuals who are interested in the conservation of birds. More recently, the North American Bird Conservation Initiative (NABCI) was developed to integrate these plans through a suite of regionally-based, biologically-driven, landscape-oriented partnerships that deliver the full spectrum of bird conservation (Williams 2003). Integration across taxonomic, cultural, and geographic boundaries is needed to fully achieve bird conservation (Andrew and Andres 2002).

For the Service to meet the challenges of the 21st century and to fulfill its responsibilities to the U.S. public, our deliberations about bird conservation must turn into action in three primary areas: (1) sound science, (2) strategic planning and (3) partnership-driven implementation. This paper outlines how increased capacity and strategic planning in the Service's Migratory Bird Program would contribute to achieving our trust responsibilities and the objectives of bird conservation plans.

Scientific Foundation

Wildlife management and conservation is changing rapidly from the opportunistic pursuit of habitat gain to the science-based pursuit of sustainability (Johnson and Baxter 2003). The success of the Service's vision for migratory birds and the vision of the bird plans depends on understanding how bird populations respond to various environmental stressors and how birds respond to measures implemented by the conservation community. The Service remains committed to the scientific process and to the use of the information generated within the research and management communities. These bird conservation priorities support design and development of conservation strategies and help to evaluate the effectiveness of management actions in meeting conservation goals.

A Service goal is to provide dedicated staff in each region and flyway to achieve effective and efficient population and habitat monitoring for all migratory birds. Development of a strong national center for science support will ensure that protocols can be easily translated to any geographic scale and can be used by any partner. With its research partners, the Service should lead the way to develop and implement standard monitoring and assessment protocols to not only better understand basic population trends, but to fully understand the causes influencing population trends. With this knowledge, the conservation community can adapt habitat management practices to attain and sustain desired population goals.

Specifically, the Service should improve the estimating process for population sizes and trends of all migratory birds through rigorous design, analysis and evaluation. Among the highest continental priorities is to replace and expand the existing aircraft fleet that is needed to accomplish many population surveys. These planes are important tools on which current and future broad scale monitoring programs depend. With new aircraft, we must also develop new information and technology for monitoring and assessing satellite data and enhanced videography.

The Service should lead regional and local development of surveys that contribute to continental flyway and regional objectives; it should encourage partners to participate in survey efforts and should assist in the application of survey results for conservation actions. The Service should compile trend data for national and continental assessments and should be responsible for public reports that describe trends and propose actions needed to attain population and habitat objectives. The Service will also support monitoring and assessing

activities that measure environmental status or other factors believed to affect population status. And, the Service promotes opportunities to test hypotheses about fundamental issues of population limitation and regulation. Our monitoring and assessment efforts must be tightly integrated within an explicit, management, decision-making process that involves biological prediction and testing in order to inform while learning about mechanisms affecting population status. Population monitoring, when coordinated with monitoring of natural and management-induced environmental changes, can inform management decisions and provide important insights into the mechanisms underlying population change.

Although the conservation and management of many species is driven by habitat availability based on well defined population objectives, the conservation and management of many other species is driven by factors that may effect populations directly and are unrelated to habitat (e.g., seabird bycatch, disease, contaminants, oil spills and collisions with human-made structures take from the wild). Specific population objectives are important for ensuring sustainable, huntable populations and for determining the significance of disturbance, mortality factors or takings of birds from the wild. Regarding the distribution of permits, Service policies and regulation promulgation are most effective when based on existing baseline population sizes and objectives, established to control increasing populations, maintain existing populations or conserve rare and declining species.

The Service will continue to refine regulations, policies and permits that provide for appropriate take and possession of migratory birds; and it will commit to an adaptive management approach to evaluate population management.

Strategic Landscape Planning

A second leadership role for the Service is to provide landscape level, strategic planning for sustaining bird populations at both bird conservation region (BCR) and continental scales. To accomplish this vision, the Service will provide leadership in BCR planning by using biological modeling, information management technology and collaboration with partners. To accomplish migratory bird conservation goals, it will integrate efforts across jurisdictions and geographic scales.

To realize the goal of integrated bird conservation, the Service needs to provide decision support tools to its managers who operate at various spatial, temporal and organized scales. Decision support involves the assimilation of

information into the conservation delivery process. This is accomplished through development of procedures for analysis and visualization of management alternatives. A variety of tools are needed to frame conservation objectives, define management objectives, integrate habitat and population information, and design conservation programs across broad landscapes.

Regionally and locally, the Service, along with its partners, will use continental population objectives to generate explicit habitat objectives at sub-continental scales. Compilation of regional habitat data for national and continental assessment is needed. The Service will lead development, implementation and evaluation of regional bird conservation plans by building and maintaining regional bird conservation networks.

Partnership Programs

Finally, a Service goal is to rededicate itself to new and emerging concepts in bird conservation. The Service was built on a foundation of concern for migratory bird conservation, and that foundation has grown stronger over time. Therefore, we must take steps to buttress that by infusing new bird conservation concepts more comprehensively throughout the agency and by seeking new partnerships and opportunities, while maintaining those partnerships that have been successful over the years.

The Refuge Improvement Act, for example, requires each refuge to prepare a comprehensive conservation plan; these plans will serve as the link between bird conservation priorities and the management of the National Wildlife Refuge System. Bird conservation priorities will also influence the future growth of the Refuge system. The Service will work to increase funding and improve the process by which the State Wildlife Grants Program, the North American Wetlands Conservation Act, the Neotropical Migratory Bird Conservation Act, and operational funds for Joint Ventures can provide for bird habitat management and can sustain conservation partnerships.

The U.S. Department of the Interior Appropriations Bill for fiscal year 2003 included \$65 million for wildlife conservation grants to states and territories (and \$5 million to tribes separately) on a formula basis under the State Wildlife Grants Program. The State Wildlife Grants Program is designed to provide federal funds to states for the development and implementation of programs that benefit wildlife and their habitat, including species that are not hunted or fished.

Both planning and implementation activities are permitted, but, to be eligible for the funds, the states must commit to development of a comprehensive wildlife conservation plan by 2005 that focuses on their species with the greatest conservation need. Once a state is found to be eligible for funding, it will submit grant documents to the appropriate Service regional office for review and approval.

Another example is the North American Wetlands Conservation Act, which provides funds that develop voluntary and nonregulated partnerships across diverse interests for the common objective of conserving wetlands habitats and the birds associated with them. The Service and nearly 1,750 partners achieve wetland conservation, land and water conservation, water quality improvement, wildlife habitat improvement, public recreation availability and economic benefits. To date, we have worked together on close to 1,000 projects in 48 U.S. states, 13 Canadian provinces and 24 Mexican states. The nine-member North American Wetlands Council recommends projects for final approval by the Migratory Bird Conservation Commission. The act furthered the habitat objectives of PIF, shorebird and waterbird recovery plans; the council is making further advances to solicit and fund wetland projects that relate specifically to those initiatives. The act was appropriated at \$38.3 million in fiscal year 2003.

The Service and its partners will continue to support the growth of the Neotropical Migratory Bird Conservation Act. In 2002, 290 grant applications from 33 countries and 31 U.S. states were received, and requests totaled more than \$25 million. Requests were matched by more than \$95 million in nonfederal funds (U.S. Fish and Wildlife Service 2002). A preliminary analysis of the 2003 applicants to this act reflects a similar response. Our partners have demonstrated the need and the desire for a matching grants program to address uplands of the United States and migratory birds across the breadth of their ranges.

Joint ventures are a mechanism for development and use of locally-driven decision support tools that guide management actions; thus, they contribute to continental population and habitat objectives. Joint ventures are self-directed partnerships of agencies, organizations, corporations, tribes or individuals that have formally accepted the responsibility of implementing bird conservation plans within specific geographic area.

Joint ventures differ from BCRs in that joint ventures are administrative structures based on partnerships; BCRs are ecological planning units (see Smith 2001). Joint ventures can develop, produce, use and evaluate spatially-explicit biological models that describe population habitat relationships and identify

geographic focus areas for conservation action. The Service will help to facilitate the development of joint ventures to assure national coverage, for all priority habitat types, in the United States.

Regionally and locally, the Service must commit to increased technical assistance with public and private land managers. With our partners, the Service can provide technical assistance to landowners in focus areas, so landowners can incorporate bird conservation objectives and federal grants programs into their land management plans.

Finally, we must recognize the importance of the flyway councils and their long-standing contributions to the cooperative management of waterfowl and other migratory game birds. This successful approach to management can serve as a template for other partnership opportunities at both the national and international levels. Members of these councils will continue to contribute significantly to those partnership programs and opportunities I have already mentioned, as well as others yet to be identified.

Cross-cutting Responsibilities

Conservation outreach and international coordination are Service responsibilities to migratory bird management that cut across program areas. For outreach, the Service can lead national development of key messages, audiences and mechanisms to further migratory bird conservation, coordinate delivery of messages and provide needed tools to regional partners. Regionally and locally, we can help tailor key messages, audiences and mechanisms for local situations and deliver conservation messages to educators, students, landowners and others.

Internationally, the Service must lead efforts across the breadth of species ranges. Through the Migratory Bird Program and the International Conservation Program, the Service can provide consistent population and habitat inventory and monitoring protocols, can assist with building conservation capacity in priority areas, can assist habitat conservation and can develop consistent international outreach messages.

U.S. Fish and Wildlife Service Strategic Plan Process

The Service Migratory Bird Program announces the beginning of a strategic planning process with our partners. The objectives of the Migratory Bird Strategic Plan are to further develop the concepts presented in this paper, to

provide direction for Service leadership in conservation and to explore opportunities to better accomplish our mission by integrating bird management and conservation into other Service programs. The planning process will not only define Service leadership for conservation, but it will serve to better define the role of all our partners in this grand enterprise. The Service hopes that one product of this process will be a long-lasting and well-defined partners group, such as the Cooperative Alliance for Refuge Enhancement (CARE) for national wildlife refuges.

Several critical administrative and program actions for migratory birds cannot wait until the end of a planning process, and the Service will act upon those now. Habitat delivery programs through partnerships is a popular and successful conservation avenue that the Service will continue to grow and deliver. Only through a sound scientific foundation, reflected in its ability to apply new research and management methodologies, can the Service clearly articulate the priorities for habitat delivery programs and evaluate the success of those efforts.

The North American public demands that the Service understand how management actions, including inaction, will affect migratory bird populations. Its knowledge of current population levels is rudimentary for many migratory bird species. To remedy this shortfall, the Service will promote a significant increase for assessment, monitoring and evaluation in fiscal years 2005 and 2006. Cementing a solid scientific foundation will ensure the most effective delivery of habitat programs, will enable the Service to make informed decisions about management actions and will provide desired information to the North American public.

In February 2003, the Service elevated migratory bird conservation to an independent program led by an assistant director. The Service is called to meet its leadership responsibilities more and to ensure that it has a complete program dedicated to that effort, a program that provides reports to the director. In addition, this will provide an opportunity to integrate into other areas of Service responsibility.

Overall, the recognition of the migratory bird program as a distinct organization should allow the Service to more effectively carry out its core responsibilities for migratory birds by focusing on those program areas that are deemed integral to its trust: (1) population and habitat monitoring and assessing, (2) population and habitat conservation, (3) permits, regulations and associated policies, (4) national and international coordination and communications, and (5)

oversight of bird conservation planning. Funding support in fiscal years 2005 and 2006 must bolster these program areas if we, collectively, are to successfully conserve the migratory bird resource for future generations.

Bird conservation activities have provided a solid foundation for rapid growth over the last several years. Bird conservation plans, based on the same ecological planning units (BCRs), have been developed by partners for most of the country. The Wildlife Management Institute has recently held what will be the first in a series of partner meetings to develop priorities for bird conservation funding. In addition, the NABCI Committee provides a forum for discussion regarding integrated actions for bird conservation; many of the NABCI Committee's actions are reflected in this paper. Through various avenues, the Service is improving its ability to affect bird conservation internationally. Critical to these efforts has been a recognition that the effects of conservation actions must be predicted and discerned in terms of changes in population, rather than the more traditional terms of habitat acres secured or localized changes in bird populations.

This is an extraordinary time of opportunity for bird conservation because of the conservation community's progress in increasing biological knowledge, developing powerful technologies, forming effective partnerships and leveraging resources. The Service is eager to provide the leadership and support necessary to take full advantage of this opportunity, and it welcomes your input into its strategic planning efforts. The Service is confident that if the bird conservation community works together to face the conservation challenges today, the early years of the 21st century—like the period one hundred years ago—will be remembered as an era of comprehensive conservation.

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How to Achieve Our Vision of Bird Conservation over the Next 100 Years

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Conservation in the 21st century is a balancing act between the needs of wildlife and those of people. Visions for the future of wildlife resources range from individual species goals to broad habitat goals, such as those stated in March 2001 by the American Wildlife Partners. This group of more than 35 hunter/conservationist organizations envisions, “a future in which all wildlife and private and public habitats are abundant, maintained, and enhanced.” Other parts of that vision endorse responsible uses, policies that reward stewardship and commitment to principles of scientific wildlife management, where wildlife is held in public trust.

The bird community has produced a plethora of plans. We celebrate the success of the North American Waterfowl Management Plan; we talk about new plans for bobwhite quail, shore birds, wading birds and sea birds, and we talk of a array of geographically-specific plans for the wide variety of song birds. Plans for forest grouse, prairie grouse and turkeys exist or are being written. Looking at the North American Bird Conservation Initiative (NABCI) goal of, “conserving all birds in all habitats,” I decided this presentation should deal not with what a vision should be, because there are so many already, but to accept the NABCI goal and, instead, spend this discussion on what has worked in the past and how to do what we want to do for birds.

I see us at a crossroad, similar to one at a critical meeting held shortly after the North American Waterfowl Management Plan (Waterfowl Plan). A group of people, including several here at this meeting, from congressional staff, the U.S. Fish and Wildlife Service, nongovernment organizations and state wildlife agencies addressed the question: how do we do all the things that are laid out in this new, plan? That critical discussion led to first the concept and, eventually, the writing and passing of the North American Wetlands Conservation Act (Wetlands Act). The existence of an ambitious international plan, a commitment by state, provincial and federal governments, new partnership concepts called joint ventures, wide public support for wetlands, and energy and funding from

nongovernment sources all converged at the right time. A movement began to do things on a scale never before attempted for waterfowl habitat, waterfowl populations or many other wetland-dependent species.

Adopting the “all birds in all habitats” goal for bird conservation, two main questions emerge: (1) what will it take to conserve all birds in all habitats, and (2) how do we get things done to achieve this goal? These questions may be answered by looking at what seems to have worked in the North American Waterfowl Management Plan and its driving mechanism, the Wetlands Act.

Plans with specific objectives give us the technical answers to the first question. One of the most important advances was the construction of plans with specific population objectives for waterfowl and the relation of them to specific habitat objectives on a recognizable, geographical basis. Expanding the vision to whole landscape approaches, watershed functions enlarged the scope beyond individual wetlands. In many respects we ran quickly from the starting blocks based on the scientific appraisals of the time, and we put projects on the ground for more than a decade. Because of changes in government research programs and the urgent need to conserve habitat, we have—to some extent—neglected maintaining the long-term investment in our science base through research and monitoring. While we were successful in delivering a lot of conservation on the ground based on what we knew, we now need to expand the science base.

Some important tactics emerged. We learned that funding and programs that don’t belong to wildlife—and don’t have our name on them—can be powerful tools. In the United States, the 2002 Farm Bill affected private lands on such a scale that it immediately provided visible progress towards specific habitat goals. This scale of opportunity attracted nontraditional partners whose first interest wasn’t waterfowl, but who saw the wisdom of working with the watershed or landscape itself. Thus, we learned the value, recognized the need and seized the opportunity through government agency programs and widespread partnerships. Without the Farm Bill we would not be where we are today.

The Waterfowl Plan and the Wetlands Act, through the new concept of joint ventures, focused money, people and programs on achieving those specific plan objectives. The then new National Fish and Wildlife Foundation established its niche by pioneering a way to spend dollars generated in the United States on important Canadian habitats and still provide accountability that satisfied the U.S. Congress. Essential support from nongovernment sources, particularly Ducks Unlimited, Inc. (DU), has been essential throughout. In many respects, DU’s

growing programs have been driven for almost two decades by the needs of waterfowl and the opportunity presented by the Waterfowl Plan and Wetlands Act.

A look at the gross figures of accomplishment are revealing. The Wetlands Act reports a total of more 100 projects and more than 2,000 partners, who have contributed \$1.5 billion in partner funding, coupled with \$522 million in NAWCA grants that have affected almost 10 million acres. Lessons from this are many. We see the value of leveraging state, federal and private dollars on the ground, the value of geographically-specific targets, the value of state, federal and provincial agency commitment, and the value of starting small and growing incrementally through performance and accountability to a larger program. For instance, the Wetlands Act was \$1 million when it started. Now, close to \$50 million per year in federal money alone is available, along with at least two times that in partner funding.

The success of the Wetlands Act is a model for the next chapter in bird conservation. It gives a foundation. We must maintain the progress and respect the interests that have gotten us this far through use of these existing funding sources. They are a model, not a resource to be diverted elsewhere.

The states have been important from the beginning, through state duck stamp revenue and other donations to match programs in Canada and boost the Waterfowl Plan and Wetlands Act. The link between breeding areas in the North and migration and wintering areas in the states in the South has led to a recognition of the need to support programs far away from home. Capitalizing on people's needs and interests in maintaining habitats, both for the benefit of waterfowl and the perpetuation of the waterfowl hunting experience, has been essential to success.

The larger vision to advance the role of the states in bird conservation was the Conservation and Reinvestment Act (CARA), which almost passed in 1999. This was an attempt to dramatically increase stable funding to the states, so they could play a more important role in managing habitats and populations of all birds. This first attempt failed, but the concept remains a very important component of a capability for conserving all birds in all habitats for the future. A key to success of the Waterfowl Plan and Wetlands Act has been addressing people's needs as well as birds. We need to continue to recognize that conservation of the private land that makes up 70 percent of the United States depends upon working with people that are likely to do things for their lands in their own enlightened self

interest. Incentive approaches, partnerships and cost-sharing make more sense than regulation to achieve our goals. The future of all-bird conservation depends also upon maintenance and enhancement of the current foundations of migratory bird management, much of which are nested within the U. S. Fish and Wildlife Service, which also has statutory responsibility for migratory birds, the U. S. Forest Service and the U. S. Bureau of Land Management manage large landscapes that are key to the conservation of many species. Basic monitoring and investigations to support management needs to be strengthened and focused on meeting the needs for the future. This must include a strong partnership with the U. S. Geological Survey, which houses the research capability once housed by the U. S. Fish and Wildlife Service. We need to work across political boundaries, but we must not force people to accept a single approach. State boundaries and individual agency responsibilities are a reality. We need to address habitat and the life cycle for birds throughout the year, from north to south. We need to embrace the goals of resident species as well as migratory species because the success of the Waterfowl Plan and Wetlands Act shows us that programs can only be enhanced by wide partnerships.

The success of joint ventures has been a key to progress. They were first seen as a federal responsibility, and some have indeed been supported from the beginning by U. S. Fish and Wildlife Service staff. But the many years of working on implementation of the Waterfowl Plan led to a realization that no single funding source or federal program could get the job done. The joint ventures blossomed with the realization that they had to raise most of their own resources. Their strength comes from the fact that they are independent organizations of varied governmental and private interests that come together because of a common purpose. They have grown in number, in geographical scope, in the breadth of their partnerships, and now they have their own association. They are considering how to handle all birds in all habitats. They appear to be ready for this ultimate challenge. Since they have a strong track record of success, joint ventures offer a convenient and powerful beginning for broader bird programs.

Finally, we have learned the value of focused advocacy such as that for the Wetlands Act and its appropriations, which has grown from only \$1 million to over \$50 million annually and drawn such huge partnership support. We have learned from the model of CARE, where disparate interests have focused on those things they all share to achieve their goals, that has focused on enhancing the operating capability of the whole national wildlife refuge system.

Focused advocacy works when it separates specific, mutual goals. In bird conservation, because of the wide array of interest groups, this separation from the complex policy issues must be done. At some point money becomes a driver. We have the visions and specific plans, and we have benefitted greatly from the catalyst of the Wetlands Act. The strong support of nongovernmental organizations (NGOs), like DU and the Nature Conservancy, has been essential. Probably our biggest step was in learning to channel the use of others people's money, finding resources with someone else's name on them and addressing them to our cause. The Farm Bill and other agricultural programs are the prime example and can work for all birds as well.

The array of bird species groups, bird habitats and individual conservation needs is a large and complex package. We need to prioritize what is done to be effective, and there will be debate about that. The reality of successful coalition work is that individual groups will retain their own priorities, but, to succeed with the all-bird objectives, we have to compromise and recognize the different sets of priorities.

Where will the money come from to do what we need to do once we prioritize? The Wetlands Act is well established, is already affecting a broad array of species and can be a foundation. But, it has its own purpose. This experience shows us that, if we work incrementally, we can build from modest beginnings to a powerful program based on partnerships. We have to be patient and to work incrementally with the Neotropical Migratory Bird Act, which is a good start. In these first two years of the Neotropical Bird Act, hundreds of millions of dollars in partnerships were proposed but went unfunded, showing the need for partners to ante up.

Funding for much of the science basis can come through rebuilding and strengthening the science foundations of the U. S. Fish and Wildlife Service. Surveys, monitoring, evaluation and management through national wildlife refuges and public lands all offer opportunity. Linking bird conservation programs through NABCI to manage individual refuges is an example of how work on the land can be done and can be a powerful example for selling what we want to do.

The U. S. Forest Service has extensive research capability and a powerful impact on large scale habitats. Most habitat work on national forests will occur through expenditures for fire management, watershed management, international programs, and forest stewardship of state and private land. Once again, there is wisdom in learning to channel money that serves larger needs, such as fire management, to also provide the wildlife habitat we need.

The U. S. Bureau of Land Management is driven primarily by energy development in the current environment. There is a huge amount of money available in energy that, if freed and targeted, can have profound impact on bird habitat. Ranching and grazing management, along with special projects—like sage ecosystems and invasive species—offer huge needs and opportunities for programs that can support both research and on the ground management.

The best example of all has been the Farm Bill. We currently see \$18 billion available over 5 to 10 years for habitat work that can benefit wildlife. Much of it will focus on benefits to the landowner, such as watershed improvement, water quality improvement, erosion control and basic soil and water conservation. This requires local involvement and investment. Partnering on the ground with landowners is an avenue to success that bird groups need to explore. In addition to the Farm Bill, opportunities exist in the transportation legislation currently in Congress, and they exist through health programs to fuel bird research because of West Nile virus. New thinking will be needed to capitalize on very broad sources of support.

Who can lead all of this? A few need to lead and organize, but grassroots, organizations and all 50 states working in concert with a common goal can get us closer to our bird goals. The focus is on clear goals and objectives to get the needed resources, perhaps following the model of CARE and its work for refuges.

Early in the effort to understand how refuges serve the needs of wildlife and people, it became clear that money to operate and maintain refuges gave a refuge manager the opportunity to deal with biological, sociological and environmental issues on the refuge—all key to any public use for any purpose. CARE set goals based on documentation from the agency, worked with the U. S. Fish and Wildlife Service to provide accountability through independent evaluation to Congress, and worked for incremental progress towards larger goals. While pursuing the operations and management funding purpose of CARE, individual groups worked in their own way to support these goals. CARE employed a strategic approach to working with Congress that has led to new credibility for management.

So a question seems appropriate at this stage: could harnessing the tremendous zeal with which North Americans of all types show an interest in bird watching, bird hunting, photography and just advocacy for the welfare of birds be key to all habitat conservation for the next hundred years? If we expand our horizons for all wildlife, include fisheries for its watershed and riparian values,

address forests, grasslands, wetlands and human uses of them, could we drive habitat conservation all across North America? Suppose the needs of ducks, wading birds, songbirds, prairie grouse, deer, elk, turkeys, public recreation and a declining species or two can be combined on a watershed approach that also benefits native fisheries. Wouldn't we have a powerful message?

One way to achieve this broad and sweeping goal would be a new alliance, such as a Cooperative Alliance for Bird Conservation. This could unify a diverse conservation community around science-based, priority-driven, cooperative actions to advance bird conservation in North America; it could link the power of the wide array of bird groups that have worked through Partners in Flight for more than 12 years to assess needs, set priorities and make plans.

Through delivery of a coherent message about all-bird conservation through strong efforts to link fisheries, mammals and conservation needs, we can be very powerful in gaining attention for this conservation message. We need to open the conversation to include a wide array of interests, and we need develop that common set of objectives that has been so powerful a tool for refuges, the Wetlands Act and the Waterfowl Plan in the past.

We might consider even a direct link to the CARE effort for refuges, to capitalize on the easy connection between migratory birds and their habitats. Leading those coalitions together, or at least coordinating them, would increase our power. We also need to focus this effort with equal zeal on the National Forest System, the National Park System, and the U. S. Bureau of Land Management habitats. This is in the future, but should clearly be in our sights.

A strong way to support this would be to join forces and support this vision with whatever staffing it might need. Perhaps initially, a grant could be secured to kick it off, with the goal of self sustaining partnership within a few years. The long term measure of success would be simple. Increase funding for all bird species work to achieve the goal of conservation of all birds in all habitats.



Session Six.

Crisis in Conservation: Coping and Containing

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Crisis in Conservation: A State Perspective

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Introduction

Conservation crises transcend state and national boundaries. Unanticipated conservation calamities can be characterized as events or occurrences imagined improbable or unable to foretell, such as new aquatic or wildlife diseases. In the case of epizootics or zoonoses, there is a challenge not associated with other crises that requires speedy contingencies. Time is a limiting

factor for successfully combating these types of crises. Most conservation crises are predictable, ramifications are already known. Many stem from human population impacts; each day the global population grows by 219,000 people. Challenges common to both types of crises include conflicting viewpoints and principles, reactive approaches, misinformation or sensationalism, conflicting authorities or policies, limited funding, and inconsistent statutory and regulatory requirements.

In this paper we explore the commonalities of three conservation crises from a state perspective. These are fresh water shortage, emerging diseases and insufficient biodiversity. In each case, solutions relevant to the dilemma are outlined.

Fresh Water

Threats

Among the environmental specters of the 21st century, a shortage of fresh water tops the list. To understand the nature of this predictable crisis, it is important to understand that very little of Earth's water is available for use by all of the species that reside here. Seventy percent of Earth's surface is covered by water; however, 97 percent of it is saline. Of the remainder, 2 percent is locked in glaciers and ice leaving less than 1 percent for animal, including human, use.

On the international scene, 51 countries sharing 17 river basins on 5 continents are, "spiraling toward water disputes" (Postel 1999). A water-short world is an inherently unstable world. During the 20th century, there were 37 recorded incidents regarding water supplies where hostilities reached military proportions (Sherk 2002).

The two primary reasons for the increasing likelihood of conflict are growth of human demand and reduction of supply. Current drought in the United States likely will exacerbate these problems. In the United States, water use poses a threat to nature itself. Key examples of conflict are the reduced supplies to downstream areas of over utilized rivers, such as the Columbia River in the Northwest, the Colorado River in the Southwest and the Missouri River in the Midwest. Changes to the hydrology of transstate water create upper and lower basin conflicts (Witter et al. 2002).

North American farmers are withdrawing water faster than it can be replenished. For example, the Ogallala Aquifer may be drained by 2020 (Reisner 1993, White 1994). Through time, water withdrawal consequences affect not only the fish and wildlife dependent on the quantity and quality of river flows but

also waterfowl and other wildlife dependent on off-stream wetland habitat. Water gridlock revolves around conflicting uses of water for hydroelectric power, irrigation, navigation, industry, Native American uses, domestic consumption and the environment (Table 1). Existing federal and state laws and policies collide rather than reduce polarization of stakeholders.

<u>USE</u>	<u>WEST</u>	<u>EAST</u>
Irrigation	76	24
Thermoelectric Power	13	60
Municipal	8	9
Industrial	2	7
Livestock	1	0
TOTAL	100	100

Table 1. Diversion of surface water for various uses in western and eastern United States (Congressional Budget Office 1993)

Solutions

This century’s water dilemma is how to balance human needs with the requirements of natural systems that are vital to sustain life on Earth. A more holistic water policy is needed to adequately deal with ecological and economic issues. Gerald Galloway, chairman of the Water Resources Policy Dialogue, espoused such to the White House in January 2003.

Escalating conflicts among different users are difficult to resolve; however, conflict management offers some reconciliation (Table 2). Some solutions follow. First, recognize the sacredness of the resource. Sherk, at the 2002 World Council of Churches Conference, advocated “biocentric thinking”—manage every drop for maximum use efficiently throughout the biosphere, not just to make more water available for human use. It has been argued that we are entering an ecozoic era, during which all human institutions must be judged by their capacity to sustain planetary life. The World Heritage Convention has successfully exerted pressure to halt human exploitation near sites on its list of universally valued locations.

Second, conservationists need to increase public awareness of the intrinsic ecological value of water. Scientific findings must be clear and compelling to the general public and policy makers. Using the philosophy of every drop counts, explain water best management practices. Water conservation measures include off-stream storage, recycling, ground water banking, infrastructure repair and maintenance, and water pricing commensurate with cost of extraction.

Table 2. Potential effectiveness of selected policy tools for alternative conflicts and reform objectives. (Congressional Budget Office 1993)

Reform Objectives	Policy Tools			
	Water Markets	Water Price Reform	Environmental Allocation	Conservation Programs
Address Inefficient Allocations Between Economic Uses				
Intra-agriculture	Strong positive effect	Possible positive effect	No effect	Possible positive effect
Agriculture/Urban	Strong positive effect	Probably no effect	No effect	Uncertain effect
Address Public-Purpose Needs	Possible positive effect	Possible positive effect	Strong positive effect	Possible positive effect
Address Fairness Issues/Deficit Reduction	Probably no effect	Positive effect	Negative effect	Negative effect

Next, increase water supply and reduce the demand for water through new technology. Some argue that reallocation of existing water will be the only source of new water. Desalinization, while expensive, may add to fresh water supplies in some areas. Reengineering the flows of Florida waters in the Everglades has been seen as a technological advance.

Regionally relevant reforms, designed by watershed councils comprised of multiple representatives, may be the most successful strategy. Viewpoints on water problems and use vary from region to region and watershed to watershed. The management by problemshed versus watershed was advanced by Sherk (2002) in order to address the array of differences in agronomic, climatic, economical demographic, hydraulic and institutional issues. This concept was also recognized as a mechanism for the U.S. Department of the Interior's Bureau of Reclamation (USDI-BR) when its mission shifted from the development of water supplies to one that manages them (Reclamation Projects Authorization and Adjustment Act 1992). The control of destabilizing impacts of unilateral actions, say from USDI-BR policies, for example, will aid in this approach.

In the legal arena, flagrant misuse of water (e.g., fountain displays in the desert) should be outlawed. The legality of water use is generally a question of state law. All of the western states and an increasing number of eastern states have laws that prohibit the waste of water. The definition of waste, however, is usually expressed in economic terms. We suggest that states define the waste of water, in an ecosystem context, not solely an economic context.

The development of multilateral institutions based upon the equitable apportionment concept, condoned by the U.S. Supreme Court, will aid the water cause. A state model for federal water policy reform is one such institution. California's Central Valley Project Improvement Act of 1992 created incentives for farmers to use less water, shifted conserved water to higher-valued uses and protected fish and wildlife populations. Water problems should not be approached state by state or incrementally.

Emerging Diseases

Threats

Epizootics are largely unpredictable, potentially catastrophic events that can have detrimental impacts on wildlife, livestock and even humans. Their unpredictability presents unique challenges, especially when a disease spreads explosively, as with West Nile Virus (WNV) which crossed the North American continent in less than four years. WNV was first isolated in 1937 and has been commonly found in humans, birds and other vertebrates in Africa and other parts of the eastern hemisphere. Since WNV can be lethal to wildlife, the interaction between livestock and humans and the management of fear and overreaction are major challenges. Additional challenges are media management, citizen education, authority and expertise determination among the various governmental and regulatory entities, and effective management of the political process.

Similar challenges exist for coping and containing another disease occurrence in the United States—chronic wasting disease (CWD). While many of the challenges are similar, these emerging diseases—WNV and CWD—are quite different. CWD has existed in portions of Colorado and Wyoming since the late 1960s, whereas WNV is a new arrival. CWD spreads slowly, is known to affect only deer and elk, does not affect livestock or humans, and is thought to be caused by a mutated protein (prion), not a virus. Why are the challenges so similar for such different epizootics? The answer represents an additional challenge that exists with CWD—undeveloped science. Although much is known about CWD, there are still several unknowns concerning transmission, pathology and vectors. There is no practical live animal test or vaccine, and there are difficulties in reducing or eliminating environmental contamination. Public misunderstanding of CWD mirrors challenges similar to WNV. Misinformation,

sensational and inaccurate journalism, and inaccurate conclusions (e.g., that CWD acts like mad cow disease) result in fear and overreaction.

Solutions

Meeting the challenges presented by unanticipated crises, such as WNV and CWD, requires a rapid and coordinated response. The need for accurate information is paramount. The media, wildlife managers, regulators, legislators and citizens need access to accurate, scientific information. Dissemination of information via the Internet ensures rapid access. But, calming fear and stemming overreaction likely will take additional measures. The use of radio and television advertising, public meetings, press releases from expert authorities or organizations (e.g., state and federal agencies, Center for Disease Control, U.S. Animal Health Association, Southeastern Cooperative Wildlife Disease Study) is recommended. The need for governmental agencies to issue joint or coordinated messages is vital to keep from confusing the public.

Poor understanding of the regulatory authority of state and federal agencies is problematic. This can be overcome by forming councils or communities of the impacted agencies, meeting regularly to share the varying authorities and resolve conflicts, developing joint strategic or contingency plans, and developing joint position statements, leaflets, press releases, press conferences, or public meetings. This was done in Missouri in 1992 by the formation of the Missouri Council on Captive Wild and Exotic Animals (Council). The Council is composed of representatives of three branches of the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (USDA/APHIS)—Animal Care, Veterinary Services and Wildlife Services—the U.S. Fish and Wildlife Service (USFWS), the Missouri Department of Agriculture, the Missouri Department of Conservation, and the Missouri Department of Health and Senior Services. The Council meets twice per year and is the platform for developing joint news releases on CWD, a state CWD contingency plan, a CWD surveillance program, close coordination on WNV sample collection and disease monitoring. Such cooperation and coordination could eventually lead into policy development that would be useful in future unanticipated conservation crises.

Managing the political process also is a clear challenge during conservation crises. Demands on legislators and executive branches of government from concerned citizens can lead to unnecessary regulations,

misappropriated dollars and jurisdictional conflicts. Such dilemmas can be overcome if the involved state and federal agencies and other organizations work together to develop sound, scientifically grounded contingency plans. A recent example is the *Plan for Assisting States, Federal Agencies, and Tribes in Managing Chronic Wasting Disease in Wild and Captive Cervids* (Acord and Williams 2002), called for by the director of the USFWS and the administrator of USDA/APHIS. This effort was in response to House Resource Committee hearings and reactive House and Senate draft legislation. In the record time of four weeks, a working group, comprised of 88 federal, state, university and nongovernmental (NGO) workers, assembled a 21-page, national strategy to deal effectively with the CWD national emergency. Subsequently, legislation was withdrawn.

Biodiversity

Threats

The biosphere that gives us life is wonderfully rich. Biologists estimate the number of all species on Earth, known and unknown, to near 300 million. The greatest threat to this biodiversity is humanity's continual assault on natural ecosystems. Wilson (2002) explained that, at the present rate of environmental change, half of the world's surviving species could be extinct by the end of the century. In the United States as across the globe, biodiversity is not evenly distributed (Myers et al. 2000), and neither are the problems that affect biodiversity. Habitat destruction is the primary cause of decay of organic diversity (Ehrlich 1988).

Affluence and education levels in the United States account for the recognition by most North Americans of quality of life issues, including the protection of biodiversity. Paradoxically, that same level of affluence causes much greater negative effects on biodiversity per capita. One example of the myriad of threats to biodiversity—a threat not generally recognized nor effectively addressed—is the cumulative negative impacts of development projects. Highway construction, for example, further dissects vital landscapes important to biodiversity. The prime habitat for Missouri's black bear population is in the Ozarks ecoregion, an area with a low density of paved roads and few four-lane highways. Black bears survive best in large, contiguous landscapes. Yet, this criterion has little weight in the evaluation of the costs and benefits of

new roadways. Other examples of cumulative impacts are soil erosion, soil permeability and storm water runoff. Taken alone, these factors get minor attention during development decisions. They may even seem benign or insignificant in small scale developments. However, cumulative, piecemeal decisions result in stream and groundwater alterations that negatively impact a variety of fauna and flora. Water quality begins to suffer when as little as 10 percent of the surface of the watershed is changed from permeable to impervious.

Additional challenges to protecting biodiversity include limited conservation dollars, reactive versus proactive approaches, lack of definitive information about species of concern, misunderstanding of the ecological processes that support the patterns of biological diversity (Balmford et al. 1998) and inability of various stakeholders to agree upon the values placed upon biodiversity and the value of ecosystem services provided by healthy landscapes.

Solutions

State agencies can protect biodiversity by becoming more involved in land use by planning, by promoting smart growth, by fostering green infrastructure (Benedict and McMahon 2002) and by training developers in holistic, environmental strategies. Building proactive strategies via directed planning was recommended by Groves et al. (2002). NatureServe and The Nature Conservancy focus conservation efforts on hot spots of biodiversity, thus gaining maximum efficiency (Stein et al. 2000). These two NGOs work in concert to develop georeferenced, ecological, classification systems to ensure that the best information guides decisions. Agencies adopting similar tactics on public lands assure management consideration for species of concern and natural community integrity. One ideal mechanism for states to develop holistic, proactive strategies in the name of biodiversity is the Comprehensive Wildlife Conservation Plan, required by the USFWS upon receipt of FWS Conservation and Restoration funds via the 2001 appropriations bill. Systematic conservation planning approaches are more effective at conserving biodiversity (Margules and Pressey 2000).

Conclusion

The state agency perspective on meeting the challenges presented by both predictable and unpredictable conservation crises are summed as follows:

- Use comprehensive wildlife conservation plans to specify biodiversity strategies on public lands.
- Strive towards a biocentric approach to conservation management.
- Promote understanding and awareness of all forms of life and the value of fresh water in maintaining life on Earth.
- Provide science-based, accurate information (e.g., plight of species, reduced water quantities, true effects of CWD), and make it readily accessible via a communication clearing house.
- Reduce media hype with joint state agency communiques.
- Establish multistate committees made of appropriate agency personnel to build consensus and proactively address regulations that must be shared.
- Promote proactive versus reactive conservation measures.
- Leverage dollars for collective goals, such as new technology (e.g., live animal test for CWD, less costly desalinization and species status).
- Form broad-based coalitions between government and NGOs for proactive strategies in the political arena (e.g., Wildlife Management Institute, International Association of Fish and Wildlife Agencies, National Audubon Society).

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Communicating in Times of Crisis: Managing Public Opinion, Credibility and Outcomes

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You're having an ordinary day when your phone rings and the person on the other end tells you that a prescribed burn being conducted on agency land has just escaped and is now a wildfire. The fire, a normal management practice designed to create habitat for a highly endangered songbird, is being fanned by unexpected high winds and is roaring toward a lake surrounded by homes. Within minutes, you learn that one of the biologists who started the fire has perished trying to control it, and the fire has reached the lake and the homes. The media, the homeowners, the governor's office and the public have hundreds of questions.

The event I just described was not hypothetical. Now referred to as the Mack Lake Burn, it started on the Huron Manistee National Forest, in Michigan at 12:30 p.m. on May 5, 1980. Before being brought under control 30 hours later, it burned 24,000 acres, consumed 44 homes and buildings, and cost Jim Swiderski, a U.S. Forest Service Wildlife Biologist, his life (North Central Fire Experiment Station 1983).

Thankfully, most of you will never have to deal with a crisis of that magnitude. But, every one of you will likely face a crisis in your agency—sooner than you hope and more significant than you wish. And, it likely will not be your only one.

I'm going to talk about how you can prepare for and manage crises from a communications perspective to maximize positive outcomes related to both the crisis and your credibility, which has a tremendous influence on your ability to carry out your mission and to handle future crises.

My comments are distilled from two sources. The first is the significant body of knowledge on crisis communications that has been developed by public relations professionals in the emerging field of reputation management. The second is my personal experience working with conservation agencies and organizations for the past 20 years to use communications to achieve conservation objectives.

My approach will not be to review or critique how various conservation crises have been handled. Rather, first I'm going to talk about what you can do to prepare for a crisis; second, I'm going to offer recommendations for communications once a crisis has arisen.

It's a challenging task, given the uncertainty, complexity and high emotions that surround crisis situations. Doing so in a 15-minute presentation reminds me of the story of Moses and the TV reporter (Mathis 2002). "With the prophet still speaking in the background, the reporter looks into the live camera and says, 'Moses has just come down from Mount Sinai with God's Ten Commandments. Here are the top three. . . .'" My job today is, like the TV reporter, to give you the top three.

Preparing for Crises

How do you prepare for a crisis? How do you put yourself in a position to influence public opinion and manage outcomes? Let me offer, well, three recommendations.

Before I do that, let's make sure we are all on the same page on the issue of how important credibility and reputation are. You have heard it from previous speakers on this panel, and you will hear it from speakers that follow me. The business world has spent considerable effort quantifying how important it is. Organizations with high credibility and good reputations:

- attract and retain better employees (Cherenson 2001)
- have higher stock prices (Fombrun and Foss 2001)
- make more money (Fombrun and Foss 2001)
- survive (some even thrive from) crisis situations better (Foss 2002, Young 1996).

For conservation organizations, agencies and professions, reputation and credibility have a profound influence on their ability to achieve conservation objectives.

Communicate internally. Build an open, honest internal culture (Aud 2002). The days of treating employees like mushrooms are over. Treat employees like mushrooms, and you're begging to be deep-fried. You cannot have a good external reputation unless you have a good internal reputation (Young 1996). Employees that are informed feel involved and empowered, and they support the direction the organization is heading, which will be reflected when a crisis strikes.

Especially in public agencies, the influence employees have with the media, with communities and with important stakeholders at all levels will have a major influence—either positive or negative—on outcomes.

Build relationships with important stakeholders. Who the stakeholders are in a crisis situation depends on the nature of the crisis. But, trying to establish relationships, building trust and calling on people for assistance in the heat of a crisis is challenging at best and impossible at worst. I'm not trying to imply that people will not help in emergencies; it's just that they will be much more likely to help, more effective as well, if you are a known quantity before the crisis. And, this third party support can be critical in crisis situations (Kruvand 2002). For example, if there is an outbreak of chronic wasting disease or West Nile virus in your state, do you have established relationships and trust with the state departments of agriculture and public health and the public health community? Will you be able to contact the right people quickly to provide information or to obtain information? Will they go on camera to support your position based on their previous work for you?

Have a crisis communications team and plan in place. Whether it's a single team that plans to provide initial communications response on any crisis, or a series of teams that plan to respond to different types of crises, get something in place.

In 1998, the Arkansas Game and Fish Commission was overwhelmed with requests for media interviews a few days following a tragedy in which two young boys shot and killed five people at their school. The reporters were seeking comment following a statement made by a professor that the boys were using skills they had been taught as hunters. Marcus Kilburn, head of the agency's Information and Education Division handled much of the media response and said they did have a plan and it paid off. "If you do not have a crisis management plan, develop one, and do it NOW (Kilburn 1998)."

If you look back over my three recommendations, you might conclude that they are recommendations for effective communications in general—communicate internally, build relationships and have a communications plan. You're right. Which brings me to my most important point about preparing for a crisis.

How well you are able to manage a crisis situation that erupts both in terms of the issue and your overall credibility will be determined to a large degree by your credibility before the crisis. And, how you communicate in a crisis situation will be an extension of how you communicate in noncrisis situations. In

other words, if you are doing things to strengthen your reputation and credibility and communicating effectively before a crisis strikes, your chances of communicating successfully during a crisis increase substantially. Unfortunately, the opposite also applies.

Communicating during Crises

Each situation is unique. Which of course, is part of what defines a crisis—an urgent situation you’ve never experienced before. However, whether a crisis is caused by a natural disaster, a human-caused accident or human malfeasance, the good news is that the general approach you use from a communications standpoint in each situation is very similar.

When it comes to case studies in crisis communications, the case most often referred to is the Tylenol™ poisonings. On September 30, 1982, a Chicago woman died from cyanide poison contained in a Tylenol™ capsule. Within 24 hours, 6 more people would die. The response by Johnson and Johnson™, the owner of Tylenol™, both in their actions and their communications efforts (receiving 2,500 media calls in two weeks) set the standard for crisis management. Lawrence Foster, Johnson and Johnson Vice President for public relations at the time, managed the communications response. In a recent article, he offered what he called simple lessons for success that some communications professionals still have not learned. Of course, there are three of them (Foster 2002):

- Take actions that serve the public interest.
- Do so in a timely way.
- Tell the truth.

Serve the Public Interest

The first (and most critical) measure by which your stakeholders and the public will judge you is the degree to which they feel your response to the crisis is in the public’s interest. They will measure that by what you do and what you say. This applies to the corporate world and, I believe, applies even more so to public agencies (Henry 2000, Foster 2002). Figuring out what action will really serve the public interest or, to put it another way, to do the right thing is usually not very difficult. It’s actually doing it and communicating it that is the challenge.

If there is anything that consistently predicts how an organization’s reputation will fair during and after a crisis, it is the degree to which they take responsibility or accept accountability for their role in the situation (Henry 2000,

Kruvand 2002). How you go about doing that varies with the issue and, of course, how much responsibility you have. Attempts to shift blame or explain away your role, especially early in the crisis, can be damaging even if you're being honest.

Do So in a Timely Way

You must communicate you are serving the public interest and you must do it in a timely way. And, with few exceptions, that translates to quickly.

- “Tell it all and tell it fast.”
- “Be the bearer of bad news.”
- “If you don't react very, very quickly, with the right message and the right messenger, the consequences can be extreme” (Public Relations Society of America. 2002a).
- “Be the source of bad news, not the victim of it” (Henry 2000).
- “If you don't tell your story, someone else will” (Council of Public Relations Firms 2000).

The bounty of clichés confirms this approach.

Communication, internally and with critical stakeholders, must begin immediately. Communications with the media and public should begin sooner than is your natural inclination. Resist the temptation to gather all the facts before you communicate. As soon as possible, communicate that you are in control, in touch and what you know at that point.

James Lukaszewski said, “No one really knows who first said ‘silence is golden,’ but more than likely it was an attorney.” (Henry 2000). In many crisis situations, there is a tug-of-war between communications managers and legal counsel. Communications people argue to be forthcoming and talk openly, while attorneys argue to stay silent. When attorneys win those debates, the organization will usually lose (Henry 2000). A no-comment approach will not hold up in the court of public opinion, and, very likely, it will not help you in the court of law (Henry 2000).

The Internet has recently emerged as an effective communications tool. Reporters and the public are increasingly turning to the Web for breaking news information (Wright 2001). The Web gives you the chance to communicate in an almost continuous fashion without going through the filter of the media and their inherent priorities and biases (Rodrigue 2001, Wright 2001). It also allows you to make detailed background information widely available, which is almost impossible to do otherwise. Surprisingly, recent research indicates that news

found on the Web is considered by the public to be just as credible as news from traditional media, and in some cases more so (Wright 2001). Of course, the Web also offers those same advantages to others who may have different perspectives of a crisis.

When most of us think about communicating during a crisis, we think about media relations, and rightfully so. However, it's critical to keep communications with the media (and in turn, to the public) in perspective, relative to other important audiences. Henry (2000) recommends the following order of notification with important information related to a crisis:

1. those who implement and manage the communications response
2. those who will be asked to comment on the situation publicly or speak for the company
3. those who will support the communications response
4. those with a special need-to-know (e.g., senior management, family of the victim(s), off-site response agencies and government officials)
5. the news media and general public.

In many of the complex natural resource-related crises, critical people in categories 2, 3 and 4 above may not be within your agency or organization, thus not under your control. Sister agencies, employees and others should not hear important information for the first time through the media. For example, in the case of a wildlife disease outbreak, new information from the agency should be communicated directly to state and local health officials before being released to the media.

Tell the Truth.

Spin—tell half-truths and reveal half of the story—at your own risk. This is sometimes difficult in politically-oriented agencies where spinning is standard procedure. People accept that accidents happen or that people make mistakes. What they want to know, and are most likely to judge, is how you are going to fix the mistakes (Chief Executive 1995a, 1995b). A survey indicated that 95 percent of people are more offended about a company lying about the crisis than about the crisis itself (Henry 2000). In today's world of freedom of information laws, the Internet and investigative journalism, lying or spinning often causes more problems than it solves. Contradictory and conflicting information is too easily accessible (Weiner 2002).

In the whirlwind of a crisis, perceptions usually override facts (Scudder 2002). Choosing the people who will be the public face of a crisis may have more

influence on outcomes than the messages those people are communicating (Public Relations Society of America 1999). In other words, while information itself is important, the credibility of its source influences how much is believed (Public Relations Society of America 1999). Who is most credible will vary, depending on the issue, but recent research provides some interesting insights. A national survey on credibility conducted by the Public Relations Society of America (1999) found that:

- In general, local public figures had more credibility than national public figures.
- In general, insiders or experts had the highest credibility.
- The reservoir of credibility varies according to the issue.

The survey also assessed the credibility of 44 different, “sources of information in general,” among the public (Public Relations Society of America 1999). The three most credible were:

1. Supreme Court justice
2. teacher
3. national expert.

The three least credible were:

42. public relations specialist
43. famous entertainer
44. television or radio talk show host.

The upshot is that you should choose the spokesperson or spokespeople very carefully. Don’t automatically assume that the agency director or the chief of public affairs is best. People with credentials related to the issue are often going to be most effective. For example, the agency veterinarian or chief of research may be more appropriate for a disease outbreak issue, while an experienced firefighter now in an administrative role may be most appropriate during a fire. These spokespersons need to have communications and media training before serving in these roles.

Conclusion

I would like to emphasize a point that should infuse every aspect of your communications planning and response in a crisis situation. That is showing that

you care. In our pursuit of being objective scientists and managers, we often seem detached and uncaring to a public that usually makes decisions based on attitudes and emotions (Manfredo et. al. 1997). Given the complexity of natural resource issues and the inherent nature of crisis situations, stakeholders and the public attach a lot of significance to whether you seem to care, and this will relate directly to whether they feel you are serving the public interest. Use the information you've gathered here today to guide your efforts, but regardless of what you say or do, show you care.

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Desired Condition— The Missing Link in National Forest Planning

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In *Alice's Adventures in Wonderland*, when Alice is unsure about which way to go, she asks the Cheshire Cat for direction. The cat responds, “Where do you want to get to?” When Alice answers, “I don’t much care where,” the Cheshire Cat replies, “Then it doesn’t matter which way you go” (Carroll 1992).

Such is the dilemma facing national forest management. The national forests in the Rocky Mountain Region face a two-fold crisis. First, is the resource damage, including loss of habitat, biodiversity and biological components of ecosystems, from unprecedented wildfires and insect epidemics. Second, is the lack of strategic goals, defined in a landscape level desired condition and incorporated into forest plans, to reduce the risks of future, additional losses.

Setting

The national forests in the Rocky Mountain Region (Colorado, South Dakota and Wyoming) are among the most diverse and beautiful in the country. These forests provide wildlife and fish habitat, clean water, recreational opportunities, wood for timber products, and jobs that help to sustain and to diversify local communities and economies.

Forest types in these national forests include ponderosa pine (*Pinus ponderosa*) at the lower elevations, lodgepole pine (*Pinus contorta*) and mixed conifer (*Pinus ponderosa*, *Abies concolor*, *Pseudotsuga menziesii*) at the midelevations, aspen (*Populus tremuloides*) at mid- to high elevations, and spruce-fir (*Pices engelmannii*, *Abies lasiocarpa*) at higher elevations.

The ecology of these forests is disturbance-driven, with a history of wildfires, insect epidemics, windstorms and disease infestations. Historically,

these disturbances served to periodically rejuvenate forests, ensuring a mosaic of forest type, age, structure and density across the landscape. This landscape-level diversity was not only the result of past disturbances; it was also inherent protection against the size and effects of future disturbances.

Forests at Risk

Today's forest conditions are significantly different than historic "natural" conditions (Romme et al, 2002). Major contributors to reducing the diversity of forest types, ages, conditions and densities in the region's forests have been the virtual exclusion of fire, coupled with natural forest growth and reductions in forest management. Many of the region's forests are unnaturally dense and concentrated in older age classes, with virtually no significant forest acreage in the 0 to 20-year old classes. This lack of diversity, along with intense competition for water and light, has left many forest stands vulnerable to insect and disease attack, catastrophic wildfire, and other types of damage on an inordinately vast scale (Colorado State Forest Service 2001).

In 1992, the Rocky Mountain Region's annual report predicted that, "following decades of suppressed natural fire, many forested ecosystems—their age, density, and species composition—have reached a mature stage where insect infestation and catastrophic fire are the next likely events" (U.S. Forest Service 1992). Unfortunately, that prediction has proven itself all too true, given the subsequent bark beetle epidemics in all three states and the largest forest fires in the modern history of Colorado and South Dakota (U.S. Forest Service 2000, U.S. Forest Service 2002,).

Regionally, annual forest growth and mortality significantly exceed harvest, and the annual accumulation of additional biomass in forests that are already overstocked further exacerbates the potential for catastrophic events (Figure 1).

Annual trends of both acres burned and acres with insect infestations have increased sharply across the region over the past decade (Figures 2 and 3). Perhaps more alarming than the simple number of acres affected is the stark departure from historic norms in the severity and spatial extent of individual wildfire and insect events (K. Allen, personal communication 2003). Today's wildfires and insect outbreaks simply do not contribute to biological diversity in the same ways they once did. More acres are burning or beset with insects or disease, and each instance seems more immoderate than the last.

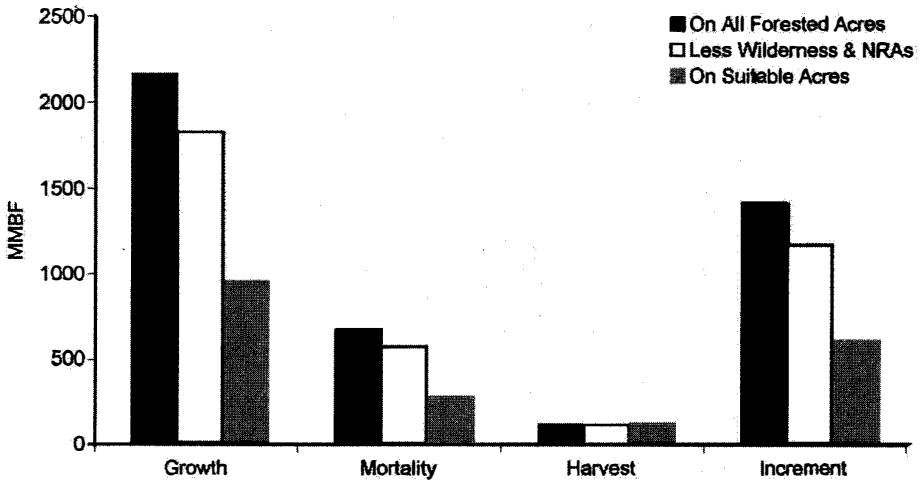


Figure 1. Annual increment resulting from growth, mortality and harvest on national forest lands in the Rocky Mountain Region (personal communication, U.S. Forest Service 2002)

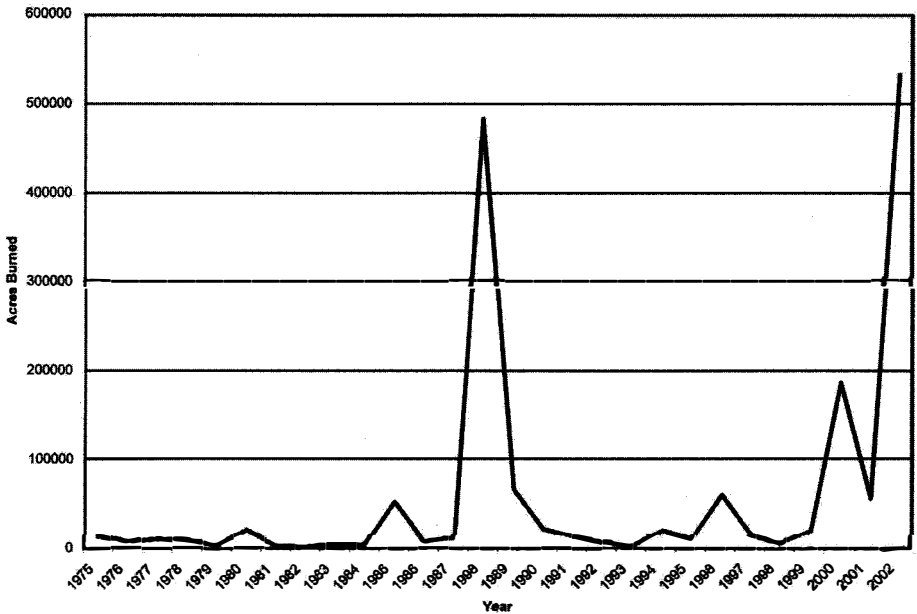


Figure 2. Annual acres burned by wildfires on national forest lands in the Rocky Mountain Region (personal communication, U.S. Forest Service 2003)

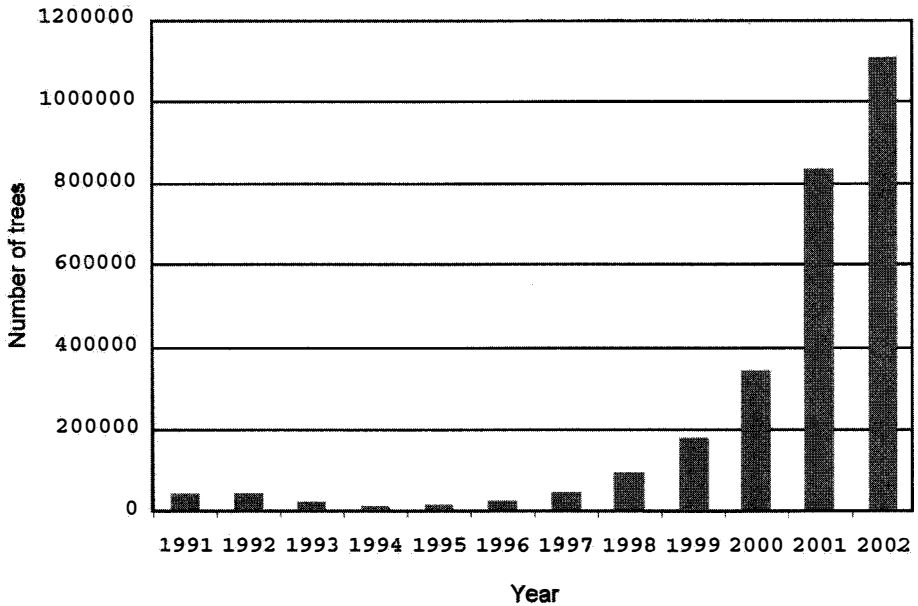


Figure 3. Number of trees killed annually by mountain pine beetles on national forest lands in the Rocky Mountain Region (personal communication, U.S. Forest Service 2003)

Habitat at Risk

The importance of wildlife habitat on the national forests cannot be understated, and wildlife issues are among the most complex in national forest management. Both wildlife biologists and foresters understand that a diversity of habitat at various spatial and temporal scales in a forest structure will result in more and different species of wildlife. Generally speaking, a forester describing a regulated forest with a proportionate distribution of age and size classes and a wildlife biologist describing a mosaic of habitat conditions are likely visualizing similar patterns of diversity across the landscape. Forest managers cannot have the desired quality of wildlife and the abundance of species without the full range of habitats, including openings, early successional plant species, late successional plant species and dense forest stands. A variety of wildlife depends on a variety of habitat conditions. No single forest, young or old, conifer or hardwood, can provide suitable habitat for the full array of forest wildlife. But, a diverse landscape, supporting young and old stands of native forest types, is crucial to sustaining local wildlife populations.

Wildlife biologists should not take lightly the risks associated with current forest conditions in the Rocky Mountain Region. While some groups have rationalized the benefits of even the most severe fires and insect epidemics in the name of Mother Nature, these fires and insect epidemics have had significant effects on basic values, like water quality, air quality, forest soils, forest structure and old growth. Many important aspects of wildlife habitat, including winter range, hiding cover, thermal cover, and nesting and foraging habitat, have also been lost or damaged over wide areas.

Planning for the Future

Wildlife biologists, foresters and the ecosystems they manage all stand to benefit from implementing strategies that will reduce the risks of these catastrophic events. Yet, despite the compelling risks, very little strategic planning has been initiated in the Rocky Mountain Region to address the potential for unprecedented landscape-scale disturbance events. Instead, most time and analysis are invested in identifying and minimizing the short-term risks of forest management projects. This approach fosters mountains of fine-scale analysis, but lacks entirely in contributing to the accomplishment of coarse-scale objectives.

Numerous projects have been successfully implemented in the Rocky Mountain Region to reduce the risk of wildfires and insect epidemics (Lynch et al. 2000). However, disparate 1,000-acre projects cannot individually address landscape-level age class or structural stage imbalances and their resultant 100,000-acre fires and insect epidemics. These risks are best addressed in the national forest land and resource management plans, or forest plans. The forest plans, as directed by the National Forest Management Act, provide the framework for management of each national forest for 10 to 15 years. They offer the single most opportune moment to develop strategic objectives that address forest-wide biodiversity, habitat and forest health conditions.

Some of the national forests in the Rocky Mountain Region have now completed the revision of their forest plans, while others are in process. By and large, the completed revisions include some cursory, 50-year predictions of increased risks of fires and insect epidemics, but none of those forests have seriously considered, let alone adopted, forest management strategies to address those risks. Recent forest plan revisions have focused primarily on development

of standards and guidelines for protection and mitigation during implementation of localized projects instead of landscape goals and objectives.

Symptomatic of this approach, long-term sustainability goals are foregone in favor of project-level mitigation measures. Using the Medicine Bow National Forest as an example, their 50-year projections for the proposed forest plan revision, “preferred alternative,” show a structural stage distribution more skewed and imbalanced than the current conditions (Figure 4). Further, the Draft Environmental Impact Statement acknowledges that, “the model is unable to harvest a sufficient amount to achieve a more balanced or fully regulated forest as is generally desired,” and predicts a doubling of acres burned and acres infested by insects if the preferred alternative is implemented (U.S. Forest Service 2002).

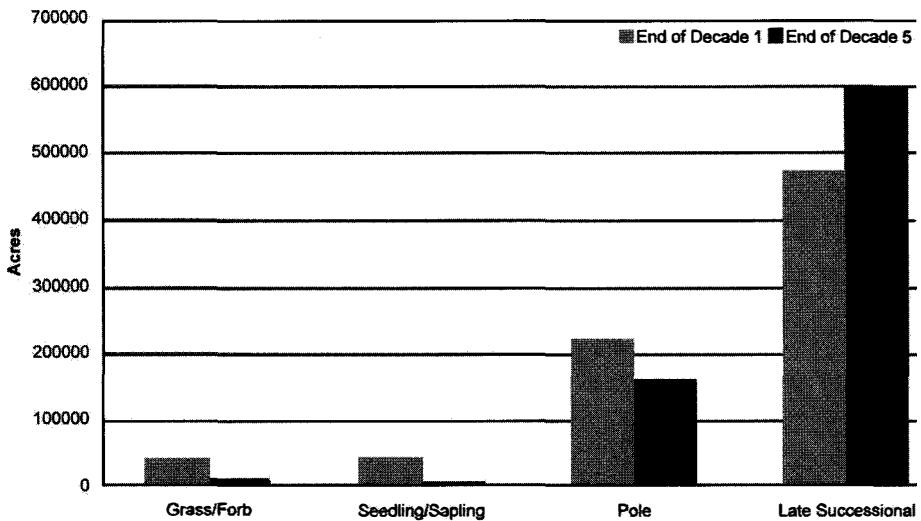


Figure 4. Structural stage distribution at decade 1 and decade 5 for Medicine Bow National Forest preferred alternative for forest plan revision (U.S. Forest Service 2002)

The key missing component from the forest plan revisions is *desired condition*. “Desired future condition” is one of the specified contents of a forest plan (Code of Federal Regulations 1997). Yet, to the extent that desired condition has been included in revised forest plans to date, its use has been as a description of the results of implementing the plan, rather than as a goal-setting macrovision for the development and implementation of the plan (U.S. Forest Service 1997).

To be effective, desired condition must include a description of desired age class and structural stages, and it must include a description of distribution of forest conditions across the landscape. The plan would then provide a strategic path to its accomplishment. The desired condition provides a vision. The desired condition cannot be so broad that it becomes meaningless, nor can it be so narrow as to provide no flexibility for changed conditions. Key considerations for development of the desired condition would include a balance of wildlife habitat needs and forest structural stage and age-class distribution that would meet insect, disease and wildfire goals. With the advent of new techniques and planning tools, forest managers can test multiple assumptions and objectives under different alternatives or management strategies (Johnson et al. 1998).

To be sure, development of desired condition will be accompanied by a full and vigorous discussion of all the stakeholders. But, once a desired condition is adopted, “forest management actions would be guided by a comparison of the existing condition to the desired future condition. Where timber harvest is scheduled, these actions should be stated as a prescription that focuses first on the actions needed to achieve the desired structure and composition. The volume taken is the result of applying the prescription” (Committee of Scientists 1999).

One example of applied desired condition, albeit narrowly defined, was developed for goshawk management in the southwestern United States, manifested in a document generally referred to as the *Southwest Guidelines* (Reynolds et al. 1992). Information on goshawk nesting habitat, foraging behavior, and the food and habitats of selected goshawk prey was synthesized to develop a set of management objectives, desired forest conditions and management recommendations with the key objectives to provide habitat conditions for goshawks and their prey species. The desired conditions include recommended mixtures of regenerated areas, midaged forests, mature forests, old forests, snags, downed logs, woody debris and interspersions of different tree sizes across the landscape (Figure 5).

In 2000, one alternative to amend the Black Hills National Forest Land and Resource Management Plan proposed a desired condition that was based on application of the *Southwest Guidelines* across the entire national forest (U.S. Forest Service 2000). That alternative was opposed by many groups, including the forest products industry, because the desired condition was so narrowly focused on goshawk habitat that, in effect, all other uses and users of the national forest would have been trumped by a desired condition for a single species (a dilemma not without precedent).

Stage	dbh	Description	Proportion of total area	Minimum canopy closure
1	0-1 inches	Grasses, forbs shrubs (opening)	10%	--
2	1-5	Seedling-sapling	10	--
3	5-12	Young forest	20	--
4	12-18	Midage forest	20	40%
5	18-24	Mature forest	20	40%
6	24+	Old forest	20	40%

Figure 5. Vegetation structural stages and their prescribed distribution by area and canopy closure under the southwest goshawk guidelines (Reynolds et al. 1992)

While not entirely satisfactory for broader forest planning, the *Southwest Guidelines* are useful as a conceptual starting point. The purpose of this paper is not to recommend either the outcome or format for desired condition. However, including recommended proportions of structural stages and age classes across the landscape will help to ensure sustainability of all the components of the forest and simultaneously discourage disastrous incursions of the destructive agents of fire and insect epidemics. In the end, however, each of the national forests is unique, and a desired condition for one national forest might be totally unacceptable for another.

Just as desired condition will be integral to establishing project and treatment objectives, it will also be an integral benchmark for forest plan monitoring and evaluation. Monitoring will determine: (1) whether management actions are moving the landscape toward the desired future condition, (2) whether treatments need to be adjusted to achieve this condition or (3) whether reevaluating the desirability of the future conditions identified as the goal are necessary (Committee of Scientists 1999). Monitoring will be most effective for the forest plans that contain the clearest desired condition.

Role of Forest Products Industry

Achieving forest plan desired conditions will, in most cases, require mechanical treatments, including timber harvest. Success in achieving forest plan desired condition will require cooperation from the private sector, including loggers and sawmillers who have the skills and incentive to help. In addition to achieving project objectives, removal of trees will provide raw materials to forest products companies, wood products for consumers, and jobs and economic diversity in local communities. Restoring forest health can support a

commercially self-sufficient timber program without subsidies (Little 2003), a fact increasingly important to federal agencies given current and projected federal budget deficits.

The symbiotic relationship between the national forests and the forest products industry rests on the critical need for certainty and predictability. As the Committee of Scientists pointed out, “Still there is the desire for predictability in timber-harvest levels. Without some notion of the magnitude of likely offerings, it is improbable that investments will occur in wood-processing facilities. Just as the timber industry in many parts of the county requires outputs from the national forests, the national forests need a functional timber industry to help achieve long-term goals for these lands” (Committee of Scientists 1999).

Fire suppression, the natural growth of forests and recent reductions in forest management have all played a role in setting the stage for the crisis facing the national forests in the Rocky Mountain Region. Averting this crisis cannot occur until the U.S. Forest Service makes a genuine transition from using desired condition as a description of forest plan results to using desired condition as a strategic vision of long-term forest conditions that guides development and implementation of the forest plan for each of the national forests.

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A University Perspective on Crises in Conservation

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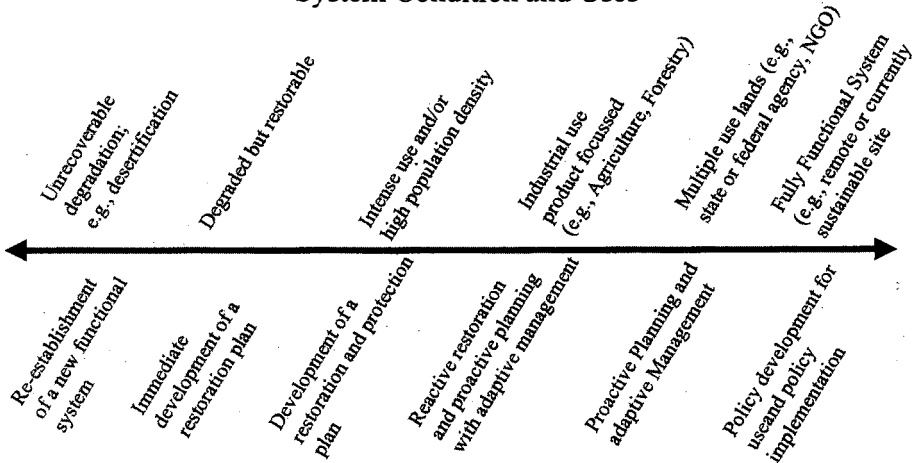
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Amherst

Introduction

Approaches to sustainable management of natural resources must achieve protection of resources while meeting the needs of people. Resolving threats to wildlife and natural resources conservation is rooted in identifying effective approaches that balance resource uses in a manner that allows both a viable human society while maintaining a suite of human values over a range of spatial and temporal scales. A review of our past land use decisions in the United States, as well as in other parts of the world, makes it clear that we need to consider humans as integral components to natural systems. In areas of the world where human population density is excessively high or where global economics exacerbate local natural resource extraction, sustainability may not be possible without first controlling human population growth or paying all costs associated with resource use (societal costs as well as natural costs). In less populated areas of the world and in areas where resource abuse has not led to costly recovery efforts, biodiversity goals can be achieved effectively through interdisciplinary planning and thoughtful plan implementation. These two conditions, degenerated systems in need of restoration and healthy systems in need of planning for future resource protection or production, represent points on a continuum of conditions and actions (Figure 1). The vast majority of ecosystems in the world have been impacted through active use, management or human intervention in natural processes (e.g., fire exclusion, flood control). The demand for thoughtful planners working on interdisciplinary teams to achieve a sustainable production of values should never be higher than it is now. We certainly are seeing a proliferation of interdisciplinary approaches to natural resources management in this and other developed countries. These can be supported by training from developed countries; there is interest in addressing issues in an interdisciplinary manner in developing countries as well.

System Condition and Uses



Examples of Related Management and Policy Actions

Figure 1. Continuum of ecosystem conditions and management actions that can be addressed using interdisciplinary approaches. Students using case studies and interdisciplinary problem-solving exercises should be better able to address these issues in the future.

The Context for Addressing Current Threats

Current threats to biodiversity often are the outcome of societal decisions driven through human values and political processes overlain on a biophysical template (Figure 2). Key to understanding these threats are several aspects of interdisciplinary approaches to natural resources management. First is a need to understand the evolution of human values within the societies where management is occurring. These values, driven by cultural mores that are often established through historical events and religious beliefs, change in response to a variety of interpersonal, biological and physical factors. Indeed, different cultures view a common resource very differently, and these values change over time. For example, people in North America have viewed white-tailed deer (*Odocoileus virginianus*) and beaver (*Castor canadensis*) as food resources, fur resources, agricultural pests, traffic hazards, sporting opportunities, aesthetic attractions, spiritual beings and health risks (through Lyme disease and *Girardia* association). How will they be viewed 10 to 20 years from now? Management plans developed for these and other resources must recognize and not prejudge these values, and they must be adaptable to addressing future values not currently recognized.

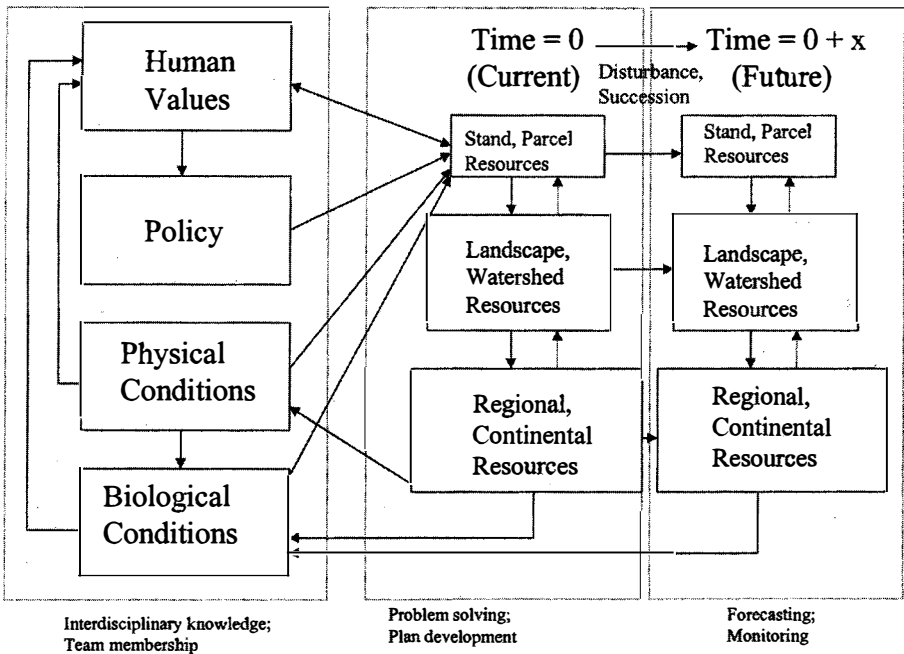


Figure 2. Flow diagram indicating the primary areas of natural resources problem-solving and needs for interdisciplinary education (dashed boxes) and the primary linkages among them to find a solution to a problem and to implement adaptive management.

In addition, educational efforts can proactively change value systems within cultures, increasing the probability of success for a management plan. Indeed, it should be apparent to planners and scientists that they can also be educators, influencing the strength of societal values. Complete detachment of planners and scientists from the resources they are managing is not possible nor desirable. Treading the fine line between commitment to the resources and maintenance of objectivity is necessary to maintain credibility and open-mindedness, which is needed to resolve interdisciplinary problems.

Second, political interactions within and among towns, counties, states and countries must be recognized. Clearly, there are existing policies that must be followed during development of sustainable management plans to protect biodiversity. Policies evolve in response to changes in human values, but the aggregation of policies over time do not always achieve a desirable balance. For instance, during the northwest forest planning process, many pieces of legislation had been put into place prior to the plan development: the National Forest

Management Act, the National Environmental Policy Act, the Endangered Species Act, the Clean Water Act and state forest practices acts. The aggregation of these policies did not adequately address the spatial and temporal scales of forest change to protect species at risk. Rather, the Northwest Forest Plan took a new approach that considered these policies and went beyond them to plan management actions on federal lands. Further, the implementation of forest management on multi-owner landscapes can leave long-term effects on production of a variety of resources (Spies et al. 2002). These effects are particularly apparent in areas where parcelization has proliferated. Indeed, understanding the behavior of landowners during implementation of policies is a challenge that must be met to allow prediction of future resource availability (Figure 2).

Third, the physical template upon which humans and resources interact may be viewed as relatively stable, but there is considerable evidence to suggest otherwise. Landslides, volcanism, floods, coastal erosion, sea level rise, climate change and proliferation of the human infrastructure all are physical conditions that are constantly changing and interacting. Farms that were once pastures and fields in New England are now forests. Mount St. Helens changed a large northwest landscape. Levee systems and dams have changed deposition patterns along rivers in many developed countries. Air and water quality have affected the distribution of biota across landscapes. Effects of human values and policies on the physical environment are quite apparent, and the rates of change and long-term effects must be predicted to understand changes in resource availability (Figure 2).

Finally, the biological systems that respond to societal, political and physical changes must be understood. It could be argued that past natural resources programs in the United States and elsewhere, have focused largely in training students within this area. Students understand well the concepts of population growth, ecological succession, solar constants and net primary production. But, do they understand these and other biological concepts within the framework of the other three components of this context? Traditional disciplinary approaches to natural resources continue to be important when training students who possess the biological background to address specific issues. However, more attention is being given to training students who can address problems within interdisciplinary teams. The graduates of these programs must have the background in social, political, physical and biological systems that allow them to communicate effectively with other managers and scientists and

integrate information among these disparate areas. Further, research faculty are beginning to move more comfortably to interdisciplinary research programs that involve team approaches to gaining knowledge (Spies et al. 2002).

Threats to Biodiversity Conservation

What are these threats that so often require interdisciplinary resolution?

Threats to biodiversity and natural resources across the world include:

- land use and land planning that moves the biological or physical template for biodiversity out of the range of natural variability (Turner et al. 1998, Landres et al. 1999)
- homogenization of ecosystems across latitudinal zones due to spread of exotic invasive plants and animals (Williams and Meffe 1998)
- proliferation of contaminants and spread of infectious diseases among humans and other organisms with wild animals as vectors (Schmitt 1998)
- alteration of hydrologic and climatic events due to changing atmospheric conditions and human infrastructure (Schneider and Root 1998, Herrmann et al. 1998)

Each of these threats can be addressed within a decision-making framework representing local, regional, continental and global societies (Figure 2). The university challenge is to train students and develop information and approaches to lend techniques, technologies and alternative solutions to these problems.

Land Use

Conversion of vegetation, either directly through establishment of a new vegetative community or indirectly through alteration of disturbance regimes, is arguably the greatest threat to biodiversity. The proliferation of land use and land cover information derived from ground-based and remotely-sensed data have been instrumental in documenting change. Retrospective analyses can be informative where data are available or can be inferred from past conditions. More powerful approaches involve understanding threats through forecasting and broadcasting likely landscape futures under current policies and regulations (Spies et al. 2002). These approaches provide a useful framework for understanding these issues and developing plans that integrate social, political, physical and biological conditions. Land use policies are usually created or altered

over spatial scales representing certain political boundaries to reduce the risk of undesirable future conditions. Goals are created through planning to achieve desirable future conditions over these areas but goals are achieved through implementation at smaller scales. It is the accumulation of multiple events of plan implementation over time and space that allow goals to be achieved. Zoning to direct development is an example of a policy designed to reduce the risk of achieving an undesirable future condition. Careful planning may result in a much more effective approach and a more desirable outcome over time and space, but success will depend on plans that are implemented correctly and upon adaptability to unforeseen risks. Adaptive management is a key component of land use plans to achieve multiple goals (Figure 2).

Invasive Species

Large areas of our environment are being homogenized. Purposeful or unintentional dispersal of organisms or propagules in environments where a species can proliferate has resulted in significant changes to the structure and function of ecosystems. With a global economy and world travel commonplace, control of the spread of invasive plants and animals is particularly problematic. Controlling the spread is possible however. Williams and Meffe (1998) indicate that many species are established in the United States at coastal states with large and active ports. Once established, spread can be rapid and very difficult to control using standard methods of vegetation or animal management. Indeed, we can quickly be placed in situations where biocontrol measures must be implemented to achieve recovery goals for an ecosystem. Principles of integrated pest management often are required to bring invasive pests under control and facilitate recovery of a system. Nonetheless, with global travel and global trade systems a significant part of world economies, humans will continue to be vectors of organisms and propagules. Human behavior and international policies will require significant changes to reduce threats of invasive species. New biological approaches involving physical, chemical, biological and genetic mechanisms will likely come to bear on this problem in integrated approaches. Universities, through research and outreach activities, can play a significant role in providing the tools that future graduates will need to address these problems.

Contaminants and Infectious Diseases

Although many developed countries have made great strides to reduce contaminants in our environment, new contaminant problems are emerging and

old problems persist in many undeveloped countries. Dichloro diphenyl trichloroethane (DDT), dioxin and other contaminants that can remain a part of systems for many years and that have the potential to affect many species within trophic systems have been identified, and control measures have been effective in reducing their proliferation. Previously contaminated sites have been identified for restoration, including use of bioremediation techniques. Emerging issues include the identification of endocrine disruptor effects on the reproductive biology and behavior of many organisms. Resolution to these problems certainly requires disciplinary education, research in biochemical pathways and research in population biology; these approaches have been successful. But, to stem the tide of emerging contaminant issues, interdisciplinary approaches that address human behavior, economics and policy assessment must also be included in the process.

Society has long been faced with diseases and parasites that result in human morbidity and mortality. The Center for Disease Control is clearly a political response to that concern in this country. Similarly, wild animals have also been recognized as vectors of these diseases for some time. Plague, rabies, yellow fever, malaria, dengue fever and Chagas are examples of such diseases and parasites that have been passed to humans through animals for centuries. Recently additional diseases have been recognized, including Lyme disease, hantavirus and West Nile Virus, resulting in concern over control of deer, rodents and mosquitoes, respectively; birds are also raising concern. Indeed, when human health and welfare are threatened by disease and parasites, values placed on wild organisms can change dramatically and quickly. Often there is an immediate call for control of the species identified as a vector of a disease, and specific population management actions are taken. Too often, the root of the problem and the identification of alternative solutions may be overlooked. Use of interdisciplinary approaches could result in changes in human behaviors, policies and habitat availability for vector species. When used in combination with medical intervention and population control, these approaches may have a more significant long-term effect on the problem.

Climate Change and Hydrologic Effects

The potential for climate change to affect the survival and dispersal of organisms across increasingly fragmented landscapes represents a significant long-term threat to biodiversity. Changes in sea levels, precipitation patterns and ultraviolet radiation protection may all be related to this problem. In terms of

immediate effects on biodiversity, alteration in temperature and precipitation regimes can have both direct and indirect effects on plant communities. Plant establishment and survival are often related to these environmental conditions, and, indeed, we have seen significant shifts in plant communities following past glaciations in response to changes in climate. Associated with these changes in plant communities are changes in the animal communities and their biophysical conditions (Figure 2). Two significant factors affect the ability of plant and animal communities to react to these changes. First is the mismatch between the anticipated rate of climate change and the rate of dispersal for many plant and some animal species. Some plants simply may not be able to keep up with the rate of change in the environment without assistance from humans or other animals. Second, land use has created barriers to dispersal for some organisms, further impeding their rate of successful dispersal across these more complex landscapes. Finally, the presence of invasive species may restrict dispersal of some native plant species because natives may be at a competitive disadvantage in new climatic conditions.

Further threats to biodiversity are changes in climate that produce changes in the frequency and intensity of disturbances, such as fires, floods, snow, ice and hurricanes. Plant and animal communities often are resistant and resilient to a range of conditions produced over time by these disturbances. Altering the disturbance regimes and increasing the range of variability, can increase the risk that some species will be lost from the system (Landres et al. 1999). Hydrologic disturbance regimes are particularly vulnerable to these effects because of the past use of dams and levees to limit the range of natural variability found in lotic systems. The communities of plants and animals affected by the conditions produced under typical flood disturbances can be altered from changes in precipitation and evapotranspiration patterns. The problem can be further exacerbated by existing water control structures. Planning for these effects and minimizing risks caused by these changes can be addressed through changes in human behavior (water use, development patterns, fossil fuel use, etc.) and policies (vehicle fuel consumption, zoning, water rights, etc.) guided by our understanding of the potential risks within the biophysical environment (Figure 2).

The University Role

Clearly the threats to biodiversity and natural resources are widespread and pervasive among countries and regions, and these threats are complex.

Universities have long played three prominent roles in addressing past resource issues: instruction, research and outreach. These three primary missions are the core of land-grant universities. Past approaches to organization of administrative units within universities have fallen along disciplinary lines. Colleges of engineering, agriculture, fine arts, and social and behavioral sciences are found on many campuses. Within these more narrowly focused departments reside even more specialized faculty. Past rewards for academic success were driven by excellence in teaching disciplinary courses, publishing in disciplinary journals and attending professional conferences. Granting indefinite tenure allowed the academic community to express views freely and was the ultimate reward for professional success. These aspects of the history of our academic culture persist on many campuses in this and other countries, but significant changes are occurring. Many campuses now have developed mechanisms for interdepartmental programs that span multiple disciplines. Curricula are becoming less rigid and more responsive to the needs of future employers faced with complex interdisciplinary problems. The distinctions among instruction, research and outreach are becoming blurred as students and faculty work together on complex problems in their own communities. Indeed, as these changes occur, campuses are faced with balancing the maintenance of disciplinary strengths with the capacity to address interdisciplinary issues and opportunities. This balance is all the more difficult to achieve because university support from state funds is restricted, resulting in the need to refocus faculty interests, forcing campuses to collaborate or both.

Curricular Changes

Many natural resources curricula are being revised to establish a balance between adequate depth in a discipline and breadth among disciplines. Curricula often require general education courses to ensure breadth, such as courses in communication skills, computer skills and emerging techniques. In addition, new courses have been developed that purposefully place students from different majors in the same course, requiring them to work together to solve an interdisciplinary problem (e.g., ecosystem management). Repeated opportunities for teamwork are offered at various stages of a student's tenure in a program, so a final capstone course is truly the final polished session in preparation for work on an interdisciplinary team with an agency, a nongovernmental organization (NGO), an industry or a graduate research project.

These changes in curricula are the result of a number of changes that have occurred in workforce planning within agencies as well as an evolving interest in interdisciplinary research among some university faculty and agency scientists. Indeed, even the names of departments and undergraduate majors have changed recently at a number of campuses to reflect a broader focus. And, new majors have been developed in response to these interests (e.g., conservation biology, environmental sciences, environmental studies). Disciplinary expertise remains important to employers, but university programs are recognizing that a broad suite of skills that go beyond traditional disciplinary lines are needed by employers.

With both tighter budgets and greater demands by employers for broad skill sets, teaching priorities must be set within programs. Not all past courses can remain as new courses are developed. This has led to greater recognition that campuses must collaborate to offer courses, often using distance education technologies. Web-based and compressed video technologies are not suited to education of students in all courses. Identification of key courses offered on one campus that may benefit students on other campuses expands opportunities. This approach is being taken among northeastern universities and is being facilitated by a U.S. Department of Agriculture Higher Education Challenge Grant. As faculty see the benefit of intercampus collaboration, campus ownership of particular disciplinary strengths becomes blurred and intercampus research and outreach opportunities may also emerge.

Natural resources instructional goals are designed to produce graduates who can communicate and work effectively on teams to resolve complex natural resources problems. Students realize that being a successful team member requires a breadth of knowledge, an understanding of specialized areas, effective communication and, especially, trust among team members. The measure of success in achieving those goals will be not through simply offering a smorgasbord of courses and assuming that graduates have the skills necessary. Rather, it will be through real-world problem-solving contributing to local complex problems. Indeed, community service learning is becoming a component of many capstone courses to ensure that students walk into the workplace prepared to address real world problems.

Research

University research initiatives have traditionally been conveniently categorized as basic or applied. Federal formula funds, provided through

congressional appropriations, have been offered in response to research needs in forestry (McIntire-Stennis Act) and agriculture (Hatch Act). National Science Foundation programs have traditionally been more focused on basic research in the sciences and technology. These sources of funds remain important to funding both short- and long-term research to address key issues and theories in natural systems. Past funding programs have largely been disciplinary in nature because scientists tended to be disciplinary, and the university programs within which they worked were disciplinary. Information gained from these research programs did indeed contribute to a better understanding of states and processes within natural and managed systems, and this information contributed to the information base needed to conceptualize interdisciplinary solutions to contemporary problems (Figure 2). Recently, new initiatives have been developed to enhance opportunities for interdisciplinary work to address threats to biodiversity, human health and human welfare. The National Science Foundation Biocomplexity Program, the ecosystems program within the competitive grants of the U.S. Department of Agriculture and the recent collaboration between the U.S. Geological Survey and the Environmental Protection Agency, has provided funds to encourage team-approach research on complex issues. In addition, grassroots efforts by scientists have led to collaborative approaches. Policy research initiatives, such as the Coastal Landscape Analysis and the Modeling Systems Project, was developed within the U.S. Forest Service Research Station and includes university and agency scientists as well as managers and stakeholders from coastal Oregon (Spies et al. 2002). Funding for this project has come from a variety of sources, but it began from scientist initiatives and support within the agency (Spies et al. 2002). In efforts such as these, teams of students, scientists, researchers, managers and decision makers work together to understand the changes in spatial patterns of resources over large, multi-ownership areas over time. The socioeconomic and biophysical resources resulting from current and alternative policies can be compared to make informed changes in policy. In this manner, all components of the system are reviewed by the team, and the solutions to the problem represent the synergy from the team's collaboration. This is quite different from having a multidisciplinary approach where scientists work on the various components individually and then try to assemble the solution after the pieces are understood. The interdisciplinary, teamwork approach takes more time, effort and communication, but it can produce a more comprehensive and credible result.

Further, the interdisciplinary approach provides a conceptual framework that directs research to meet the needs of the group, and it allows researchers to prioritize research efforts to fill specific information needs relative to the issue at hand. There are many excellent approaches to testing hypotheses that advance disciplinary knowledge, and these should be explored. Working within an interdisciplinary setting allows scientists to focus on the key questions asked of the group.

Given the growing interest and support for interdisciplinary research, why do we not see this area growing more rapidly? Two factors probably limit the proliferation of interdisciplinary research approaches to advancing knowledge. First, the reward structure for university advancement focuses on senior-authored publications and principal investigators on outside grants and contracts. This must change, especially for junior faculty members involved in team efforts. Recognition of the time and effort needed to advance a successful team effort is key to continuation and proliferation of these efforts. Second, only now is a generation of scientists entering the workforce who have received graduate training through these team research projects. There is a strong cultural imprint on students moving into research positions. Most of the current scientists in the natural resources have received training and positive reinforcement for disciplinary work. Changes to interdisciplinary work in midcareer can be difficult for some individuals. Mentoring of undergraduate and graduate students through involvement in team research efforts can lead to a new generation of scientists who begin their careers with a team-oriented philosophy.

Research approaches to complex natural resources problems require new approaches to developing and synthesizing knowledge. Universities should train students to work within this framework as educators, politicians, managers or researchers. Past models of successful scientists may not always be appropriate, and reward systems must be adaptable to these new approaches. Participation on grant proposal development, data collection and publications resulting from team efforts must be viewed highly by university administration when considering scientists for promotion. Further, students involved in these efforts should be recognized for their contributions to a collective solution that requires communication, knowledge and trust.

Outreach

Providing the information to managers, policy makers, affected professional cultures and other scientists who are addressing complex natural

resources problems should be an integral component of university teaching and research. Funding for some U.S. Department of Agriculture Competitive Grants requires an outreach component. Capstone courses within a community service learning framework provide information to managers that can be applied to current problems. The distinction among teachers, research faculty and extension specialists at land grant universities is not as clear as it once was. Each of the issues addressed as threats to biodiversity conservation, human health and human welfare, should be integrated with teaching, research and outreach programs to find solutions to the problems. The challenge is to make outreach efforts effective, given the complexity of the issues and the number of stakeholders. For instance, consider a project that addresses threats to biodiversity from continued parcelization and development of eastern hardwood forests in the United States. Massachusetts alone has 235,000 forest landowners. How do we provide information in a manner that will produce changes in land management decisions beneficial to a suite of human values? Clearly new and innovative approaches must be considered. Although Web-based and media-based information can be important to information transfer, it will only be effective if people look for it. With large complex issues, one-on-one contacts may seem impossible. One possibility is to engage community leaders in intensive training and involvement in research programs. These community leaders then are expected to interact with key politicians, landowners and interest groups in their communities. This approach has been taken in Massachusetts and Connecticut within the Coverts Program, run by Dave Kittredge and Steve Broderick. They have demonstrated significant effects on land management decisions on thousands of acres of private land in the northeastern United States.

In order to facilitate the effectiveness of both active (e.g., the Coverts Program) and passive (e.g., Web-based) outreach, we should be developing new technologies (e.g., data visualization, remote sensing, bio-informatics) to facilitate transfer of complex information to the public. Use of tools, such as geographic information systems, stand and landscape visualization, and movies of landscape change over time, can provide a quick understanding to contemporary issues and solutions without encumbering stakeholders with scientific jargon and detail.

Outreach also occurs among disciplines and among interdisciplinary groups. Open source problem solving that involves participation among scientists in Web-based advancement toward solutions to complex problems is similar to

LINUX-based computer programming approaches. Anyone can contribute to advancing knowledge and approaching a solution to a given problem, so long as they freely post their information and solutions for others to see and evaluate. With many brains focused on a problem, conceivably, an acceptable solution can be found more quickly than using traditional research and outreach approaches.

Finally, one component of outreach that needs additional attention is the management of existing information. The Web has advanced us tremendously in this regard. But, there is a tremendous amount of information that is simply unavailable to others because it is not archived and accessible (either openly accessible or password protected). Development of data banks, where data can be archived as a prerequisite to peer-review publication, can facilitate the use of meta-analysis and other data-mining techniques to address future problems. Imagine the wealth of readily accessible information if authors were required to archive data and metadata in a data bank as a prerequisite to publication in peer reviewed journals. If we started now, in 20 years these meta-analyses will not only be possible, they could help direct future research by allowing scientists to quickly determine if additional studies in a particular area will likely change our understanding of a state or process. These sorts of outreach efforts enhance research and teaching opportunities and advance our ability to address new and emerging issues with more efficiency.

Summary

Contemporary threats to biodiversity conservation and sustainable use of natural resources are complex and require individuals who are trained to be effective team members that are developing new information that can be integrated to produce acceptable solutions to problems. Solutions viewed as acceptable now may be unacceptable in the future, in a different location or in another culture. Hence, individuals trained at universities need to be able to communicate effectively and realize that solutions to natural resources problems will evolve as human values and policies evolve. Conversely, those same students, through their effectiveness as team members, can influence human values and natural resources policies by offering alternative solutions to contemporary problems. The university challenge is to be an active and adaptable participant in training team members, finding solutions and disseminating information to the affected public. Changes in the university reward system and other engrained

attributes of university culture will be necessary to ensure that we continue to advance toward meeting that challenge.

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Registered Attendance

Alabama

David C. Hayden

Alaska

Doug Alcorn, David Allen, Dennis E. Bschor, Ellen G. Campbell, Tina Cunning, Christopher Estes, Herman Griese, Winifred B. Kessler, Gary Larsen, Thomas J. Liebscher, Margo Matthews, Brian J. McCaffery, Michael B. Rearden, Steve Reidsma, Matt Robus, Mark A. Sledge, Robin L. West

Alberta

Deanna Dixon, Diane Thompson, Jonathan Thompson

Arizona

Jay R. Adkins, Roy C. Averill-Murray, Kerry Baldwin, Debbie A. Brown, Ron Day, Jim Devos, Randy English, Lisa Harris, James R. Hessel, Terry B. Johnson, John Kennedy, Sam R. Lawry, Robert J. Luce, Robert T. Magill, Jennifer Martin, Leonard Ordway, Lawrence Riley, Duane L. Shroufe, Linda Shroufe, Bruce Taubert, Bill Van Pelt, Joe Yarchin

Arkansas

Mike Checkett, Beth Ellis, Doug Ernst, Mike Gibson, David Goad, Carla Greisen, Donny Harris, Sabrina Kirkpatrick, Donald F. McKenzie, James T. Popham, Amanda J. Riggs

British Columbia

Art Martell

California

Jack A. Blackwell, Mike Casazza, Chris Chaffin, Susan Chaffin, Ellie M. Cohen, David V. Diaz, Julie J. Eliason, Rhys M. Evans, Jim Fenwood, Bob Frost, Geoff Geupel, Mark Hagan, W. Douglas Padley, Asmita Patel, Dave Smith, Murali Srinivasan, Ron Stromstad, Steve Thompson

Colorado

Arthur W. Allen, Carol Beidleman, Gary L. Belew, John Blankenship, Tom Blickensderfer, Richard Bruggers, Janice Carpenter, Len H. Carpenter, Richard D. Curnow, Thomas Deliberto, Peter Dratch, Matt Dunfee, Michael Dunning, Michael W. Fall, Aaron Flohrs, Rebecca Frank, Paul E. Gertler, Wendell Gilgert, Walter Graul, Richard E. Harness, Marisue Hilliard, Jim Hubbard, John W. Humke, David Klute, Skip Ladd, Carol A. Lively, Nora Marymor, Bonnie McCloskey, Bruce McCloskey, Robert G. McLean, Patricia Mehlhop, Loyal Mehrhoff, Brian Mihlbachler, Larry R. Nelson, Randy Robinette, Rick Schroeder, Dave Sharp, Richard Stein, Gene Stout, Jeff Trousil, Jeffrey M. Ver Steeg, Nancy Warren, Thomas L. Warren, Gary Witmer, Melanie Woolever, Mike Worthen, Luther Zachary

Connecticut

Mike Delfay, Jodi DiCamillo, Chris Dolnack, Allan G. Fletcher, Dale W. May, Brian McAward, Scott Moore, Doug Painter, Rick Patterson, Sharon Rushton, Colin Russell, Margo L. Wallace

Delaware

H. Lloyd Alexander, Melody A. Miller, Stephen Miller, Eugene G. Moore

District of Columbia

Kevin Adams, Jodi Applegate-Stemler, Ron Archuleta, Daniel M. Ashe, Stan Austin, Alex Barbarika, John Baughman, Paul Brouha, Jack Capp, Francis Cherry, Kathleen Clarke, William H. Clay, Doug Crandall, Jeff Crane, Michelle Dawson-Powell, Drue DeBerry, Kathy Decoster, Robert H. Decker, Chris Dionigi, Megan Durham, Naomi Edelson, Jacob Faibisch, Gary D. Frazer, James T. Gladen, Gary Guinn, John Hadidian, Susan Hagood, Bill Hartwig, Tami Heilemann, Mark Hilliard, Evan M. Hirsche, Heidi Hirsh, Alma C. Hobbs, Matthew Hogan, Ashlie Houston, Marshall Jones, Nicolaos Kassinis, Richard Kearney, John W. Keys III, Abigail Kimbell, Dennis Krusac, Daniel E. Kugler, Eric Lawton, Donald MacLauchlan, Andrew Manale, Noah Matson, Deborah C. Maxwell, Cal McCluskey, Sean McMahan, Thomas O. Melius, Martin Mendoza, Bruce W. Menzel, Bob Miles, Jen Mock, Lanny Moore, Fred Myers, Angela R. Nelson, Kelly Niland, Peggy Olwell, Ira F. Palmer, Barbara Parsons, Richard Parsons, Cheree

Peterson, Jennifer Peterson, Debbie Pressman, James D. Range, Mark Rey, Terry Z. Riley, Nicole Schimpf, Paul Schmidt, Jim Sedell, Bart Semcer, Mark L. Shaffer, Ed Shepard, Jill Silvey, Len Singel, Liz Skipper, Allan T. Smith, David P. Smith, Carol Spurrier, Karl Stein, Casey Stemler, Scott Sutherland, Gary Taylor, Jim Terry, Robyn Thorson, Samara Trusso, Len Ugarenko, David L. Walker, Bill Wall, Greg Watson, Kevin G. Whalen, Bryant White, Steve Williams, Tadd Allen Williams, W. Tobey Williamson

Florida

Edward Barham, John Bridges, Michael B. Camardese, Kevin Clark, Diane R. Eggeman, Joni Ellis, Will Ellis, Nat B. Frazer, Fred Johnson, Isora J. Labisky, Ronald F. Labisky, Marian Lichtler, Jerry P. McIlwain, Mari McIlwain, Rick McWhite, Ron Merritt, John Morgan, Forrest Penny, Robert Southwick, Stuart Strahl, Phillip S. Wilhelm

Georgia

Tim Beaty, Bert Bivings, Frank Bowers, Rebecca Crader, Tom Darden, John R. Fischer, Chris Frye, Sam D. Hamilton, Robert T. Jacobs, J. Mitch King, Gregory W. Lee, Mike Lucas, Roberta Moltzen, Ronald J. Smith, Linton L. Swindell, Mike Van Den Aryle, David Waller, Robert J. Warren

Guam

Robert A. Wescom

Hawaii

Paul J. Conry, Diane Drigot, Randy Miyashiro, Julie Rivers

Idaho

Stephen M. Barton, Susan Bernatas, Steven M. Huffaker, Brian J. Kernohan, Terry Mansfield, Marjorie McHenry, Terrell D. Rich, Greg Schildwachter, Katie Slavin, Dale E. Toweill, Dee Toweill, Jude Trapani

Illinois

John Buhnerkempe, Tim Hickman, Ray Marshalla, Craig A. Miller, Don Pitts, Gary E. Potts, Thomas S. Smith

Indiana

Steve Andrews, Nancy Brown, Dave J. Case, Todd Eubank, Monica Hardy, Art Howard, David Howell, Hannah Kirchner, Glenn Lange, Brady Miller, Glen Salmon, Phil T. Seng, Ed Theroff

Iowa

Lynn Betts, Judy Bishop, Richard A. Bishop, Dan Cohen, Marion Conover, Dale L. Garner, Joe Haffner, Bill Hohman, J. Michael Kelly, Terry W. Little, David Otis, Jeff Vonk

Kansas

Ken Brunson, Jason Daniels, Joe Kramer, Robert R. Manes, Mike Mitchener, Kent Monte, Doug Nygren, Anice M. Robel, Robert J. Robel, Keith Sexson, Christopher Tymeson

Kentucky

Tom Baker, Tom Bennett, Richard A. Fischer, Roy Grimes

Louisiana

Mark Gates, Gerald Grau, Chrissie Jackson, John J. Jackson III, James L. Patton, Julian Whittington, Melissa M. Whittington

Maine

Kari Schank Moore

Manitoba

Michael G. Anderson, Rick Baydack, Bob Carmichael, Dale Caswell, Lorne Colpitts

Maryland

Paul J. Baicich, Cynthia Bauer, Scott Belfit, Betty Boyland, Caitlin Burke, Julia K. Burzon, Sylvia Cabrera, Monte D. Chandler, Helene Cleveland, Mark Cleveland, Joseph P. Dudley, Vagn Flyger, Tom Franklin, Richard Fritsky, Reid Goforth, Paul W. Hansen, Ronald R. Helinski, Harry E. Hodgdon, Mary S. Hodgdon, John Housein, John Justice, Jim Kushlan, Anne Lange, Andrew Manus, Richard E. McCabe, Bette S. McKown, Jim Mosher, Linda Parker,

Toni M. Patton-Williams, Daniel A. Poole, Dorothy Poole Pete Poulos, Charlie Rewa, J. Douglas Ripley, Jane J. Sandt, Joshua L. Sandt, Steven Sekscienski, Jerry Serie, Graham W. Smith, Kay Stratman, Paul Wilson

Massachusetts

Richard O. Bennett, Stephen Brown, George Haas, Wayne F. MacCallum, Joanne Mason, John McDonald, John Organ, Mamie A. Parker, Tom Poole, Robert J. Sousa

Michigan

Mark Hirvonen, Robert D. Hoffinan, Rebecca A. Humphries, William Moritz, Betsye Prince, Harold Prince, Carl Racchini, Happi Truan

Minnesota

Edward K. Boggess, Timothy P. Bremicker, John Christian, Doug Grann, Judy Hible, Terry Hible, Karen Hollingsworth, Jeff Lawrence, Joe Mach, Harvey K. Nelson, Dave Nomsen, Barbara J. Pardo, Bill Stevens, Steve Wilds, Rick Young

Mississippi

Ken Babcock, Jim Copeland, G. Charles Fitts, Sam Foster, Ed Hackett, Myrna Heard, Pete Heard, Richard Lance, Bruce Leopold, Nancy Magee, Chester O. Martin, Ross Melinchuk, Doris J. Miller, James E. Miller, Mike Passmore, Dave Tazik, Daniel J. Twedt, Lisa Yager

Missouri

Dave Erickson, Carole Evans, Ray Evans, Kenneth E. Gamble, Thomas F. Glueck, Janet Hoskins, John D. Hoskins, Dale Humburg, Kathryn L. Kennedy, Bill McGuire, Jane A. Smith, John W. Smith, Liz Smith, Karen Thom, Rick Thom, Betty Torgerson, Ollie Torgerson

Montana

Sunni Baker, Jaralyn Beek, George Bettas, Michael A. Carter, Don Childress, Kay Ellerhoff, Roxanne Falise, Carol Ferrie, Lisa B. Flowers, Heidi Godwin, Theresa Hanley, Jon Haufler, Jeff Herbert, Thomas C. Hinz, Bobbi Keeler, Skip Kowalski, Scott Laird, David Ledford, Keith Lenard, Ron Marcoux, Dan

Pletscher, Jack Reneau, Laird Robinson, Ralph Rogers, Christopher Servheen, Chris Smith, Bob Summerfield, Jack Ward Thomas, Tom Toman, Dave Torell, Denise Wagner, Gary J. Wolfe

Nebraska

Rex Amack, William Baxter, Jim Douglas, Mace Hack, Keith W. Harmon, Tim McCoy, Bruce Morrison, Kirk Nelson, Steve Riley, Greg Schenbeck, Gene Waite

Nevada

Terry Wayne Cloutier, Terry R. Crawforth, James E. Purrell

New Brunswick

George Finney, Reg Melanson

New Hampshire

Charmion Lea Handy, Robert W. Lichvar, Dennis Slate, Judy Stokes, Steve Weber, Scot J. Williamson

New Jersey

David Chanda, John Joyce, Robert McDowell, Martin J. McHugh

New Mexico

Larry G. Bell, Dee S. Butler, Lisa B. Evans, Bill Ferranti, Harv Forsgren, Richard Gooding, H. Dale Hall, Joyce Johnson, Junior D. Kerns, Eugene A. LeBoeuf, H. Stevan Logsdon, David Mehlman, Tim Mitchusson, Patrick C. Morrow, Luis Rios, Roberta Salazar-Henry, John W. Sigler, Tod W. Stevenson, Bruce Thompson, Gail Tunberg

New York

Gerald A. Barnhart, Gordon R. Batcheller, James Beemer, Alexander Brash, Paul D. Curtis, Daniel J. Decker, Chris Dobony, Rich LeClerc, Milo E. Richmond, Peter Roemer, Eric Schneider, Douglas Stony, Larry W. Van Druff

Newfoundland

Shane Mahoney

North Carolina

John R. Anderson, Shelly Barrier, Jenna Begier, Carl W. Betsill, Paul F. Boniface, Charles S. Brown, Mike Carraway, Dan Cockman, Sarah Cross, Salinda Daley, William Dexter, Crystal Dillard, Phillip Doerr, Kelly Douglas, James M. Duncan, Elizabeth J. Evans, Jorie Favreau, Nathan Favreau, Charles Fullwood, Brad Gunn, Fred Harris, Don Hayes, Joseph Heisinger, Hank Henry, Jim Hudson, Manghan Hull, Tim Leman, Alice Linville, James R. Linville, Brandy E. Mangum, Jack Mason, Bodie McDowell, Trevor M. Minor, Terry Myers, Rick Owens, Gene Peacock, John F. Ramey, Carol Robinson, Peter J. Roussopoulos, John G. Rogers, David Sawyer, Monica J. Schwalback, Terry Sharpe, Angela Shasteen, William E. Towell, Evelyn C. Watkins, Gary West

North Dakota

Michael A. Johnson, Randy Kreil, Greg Link, Ken Sambor, Keith Trego

Northwest Territories

Kevin McCormick

Nova Scotia

Michael O'Brien

Ohio

John Beall, Ted Bookhout, Robert J. Gates, Steve Gray, Gary Isbell, Doug Jeannert, Roy Kroll, Luke Miller, Thelma Peterle, Tony J. Peterle, Frank Price, Dave Risley, Russ Rommé, Rob Sexton, Janis Wasson, Tom Wasson, Kendra Wecker, Dave Wilson

Oklahoma

Tuss Erickson, Stephanie Harmon, Ana Hiott, Toni M. Hodgkins, Harold E. Namminga, Mike Omeilia, Alan Peoples, Glen Wampler

Ontario

Lori Bilecki, Rob Cahill, Allison Grose, Cameron Mack, Deb Stetson, John Williamson

Oregon

Bradley D. Bales, Brad Bortner, Kathryn Boyer, Terry Brumley, George Buckner, Larry Cooper, Alan G. Christensen, Robert P. Davison, W. Daniel Edge, Rowan W. Gould, Russell N. Holmes, Cal Joyner, Dona J. Kirby, Ronald E. Kirby, Steve Mealey, Bill Monroe, Hal Salwasser, Janine Salwasser, Robert Trost, Donald Virgovic, David J. Wesley

Pennsylvania

Mark Banker, Bradley C. Bechtel, Glenn L. Bowers, Bob Boyd, Calvin W. DuBrock, John P. Dunn, Joseph Hovis, Scott R. Klinger, Dave B. Messics, Wilma Perago, William R. Pouss, Jonathan D. Van De Venter, Harry C. Zinn

Quebec

Danielle Bridgett, Patricia M. Dwyer, Barbara Robinson, Steve Wendt

Rhode Island

Chris Coyle

Saskatchewan

Bob Carles, Doug Chekay, Stephen Davis

South Carolina

Buddy Baker, James B. Berdeen, Albert Nelson Boles, Tammy Bristow, Dowd Bruton, D. Breck Carmichael, Jr., Dennis Daniel, Billy Dukes, Mark Dutton, John E. Frampton, Mark Garner, James Earl Kennamer, Karen Kinkead, Ron Kinlaw, Luke Lewis, Laurel Moore, Johnsie A. Nabors, Joel Pedersen, Kimberly Peters, Donna B. Ray, Stanley T. Rikard, Derrell Shipes, Scott B. Smith, Kirk Thomas, Craig Watson, T. Bently Wigley, Dave Wilson

South Dakota

John Cooper, Doug Hansen, Emmett Keyser, Chuck Scalet, Bill Smith, George Vandel

Tennessee

Bruce Batt, James Byford, John W. Lamb, Laura Lewis, Chester A. McConnell, Dorothy McConnell, Gary Myers, Gerry Taylor, Greg Wathen, Alan Wentz, Ron White, Scott C. Yaich

Texas

Clark E. Adams, Vernon Bevill, Jessica Broussard, Fred Bryant, Bob Brown, Kirby Brown, Rafael D. Corral, Lynn Drawe, Jeff Duguay, Daniel Friese, Ron George, Selma Glasscock, Josetta Hawthorne, Dennis M. Herbert, Lynne Lange, Joel Merriman, Nova J. Silvy, Eddie Taylor, Jim Teer, Geralyn Warfield

Utah

Rebecca Bonebrake, Deanna Bunnell, Dwight Bunnell, Barry Burkhardt, Jim Cole, Mike Conover, Kevin K. Conway, Daniel J. Duffield, Brian Ferebee, Richard E. Griffiths, Chris Luecke, Julie Moretti, Miles Moretti, Jack Payne, Jack G. Troyer

Vermont

Stephen K. Hill, David Houghton, Phoebe Houghton Wayne Laroche, Ronald J. Regan

Virginia

William Ballou, John L. Bardwell, Terry L. Bashore, Doug Beard, Bob Blohm, Deen Boe, Kathy Boe, L. Peter Boice, Hannibal Bolton, Marc Bosch, Robert L. Byrne, Sylvia Cabrera, Joseph Campo, Tom Cassidy, William R. Christy, Joseph L. Cook, Dave Cross, Alison Dalsimer, Nancy L. Derey, Nick Dilks, Mark Duda, Chris Eberly, Robert Ellis, W. James Fleming, Laura Fogo, Bob Ford, Roddy Gabel, Doug Gentile, Dorothy Gibb, Anne Glick, Charles Groat, Chasity N. Hart, Tim Hess, Stephanie Hussey, Mark Indseth, Peter W. Jackson, Gary S. Kania, Stephanie Kenyon, William E. Knapp, Ron Kokel, Robert Kull, Jim Kurth, Stephanie K. Lamb, Kim Lambert, Kris E. LaMontagne, Susan Lamson, Tessa E. Martin-Bashore, Janet McAninch, Jay McAninch, Chris McKay, Steve L. McMullin, Sue Miller, Steve Miller, Phil Million, Brian Millsap, Joseph C. Mitchell, Seth Mott, Marjorie Nelson, Mike Nussman, Donald J. Orth, David Pashley, Hiram J. Patterson, Jennifer Patterson, Carol J. Peddicord, Cyndi Perry, James Preacher, Jennifer L. Rahm, Kathryn B. Reis, Terry Z. Riley, Gordon C. Robertson, Anthony V. Scardina, Greg J. Smith, Bettina Sparrowe, Rollin D. Sparrowe, Fred Stabler, Tim Stamps, Melanie Steinkamp, David Sutherland, Janet Tennyson, Peter Thomas, Benjamin N. Tuggle, Jeff Waldon, Greg Walmsley, David Waterman, Robert Wheeler, David K. Whitehurst, Byron K. Williams, Margaret Willis, Lila Wills, James R. Woehr, Paula Woehr, Thomas Wray II, Carol Wynne

Washington

Rance Block, Dave Brittell, John D. Buffington, Bob Everitt, Lorin Hicks, Gerald Johnson, Anne Kinsinger, Tny Melchiors, Sandra Staples-Bortner

West Virginia

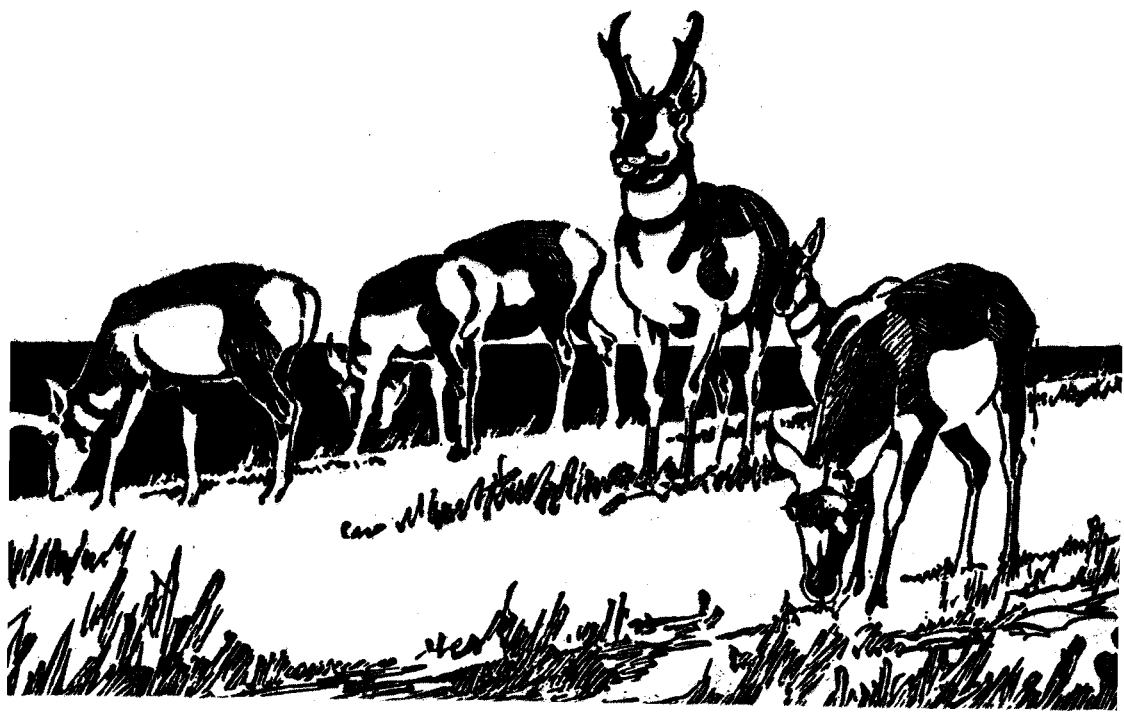
Jim Anderson, Dwight Guynn, Sally Guynn, Scott Hartman, Paul R. Johansen, Kimberley Johnson, Suzette M. Kimball, John R. Lemon, Bob Radspinner, Randall L. Rutan

Wisconsin

Kimberly Anderson, Christine Bunck, Jim S. Christenson, Dan Dessecker, David S. Dillard, Cheri Ford, Jacqueline Friend, Milton Friend, Dan Gonnering, Tom Hauge, Bob Holsman, Anne Johansen, Diane Lueck, Butch Marita, Kim Mello, Paul Neess, Cherrie Nolden, Chuck Pils, Tom Niebauer, Christine Thomas, Norm Weiland, Scott D. Wright, Arleen Wurman, Leonard H. Wurman

Wyoming

Kim R. Barber, Ann Blakley, Lynda Cook, Arlene P. Hanson, Robert H. Hanson, Brent Knotts, Larry L. Kruckenberg, Jay Lawson, Brent Manning, Robert Model, Steve Sharon, Bill Wichers, Jim Zumbo

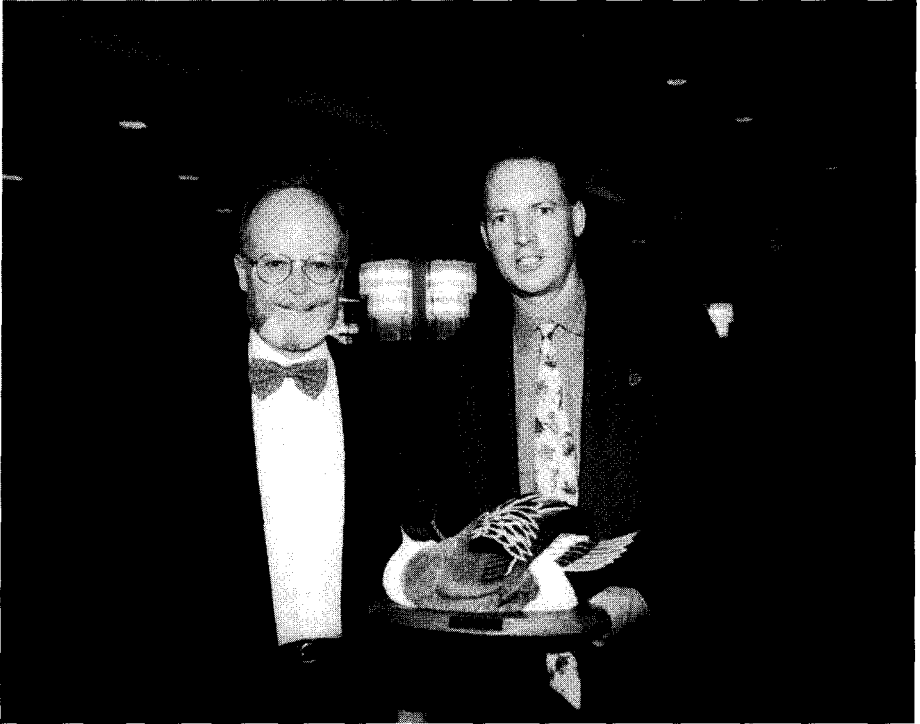




Rollin D. Sparrowe (left) presents the Wildlife Management Institute's 2003 Distinguished Service Award to Daniel A. Poole.

Daniel A. Poole honored with Wildlife Management Institute's Distinguished Service Award

The Wildlife Management Institute's (WMI's) Distinguished Service Award recognizes individuals who have made extraordinary, enduring, but largely unsung contributions to natural resources conservation in North America. The 2003 recipient is Daniel A. Poole, of Montgomery Village, Maryland. At the presentation ceremony, WMI President Rollin D. Sparrowe made no apology for long overdue recognition of one of WMI's own: "For 35 years with the Institute, including 18 years as its president, Dan Poole was a leading voice of professional reason, a brilliant policy strategist, a masterful communicator and a determined, usually behind-the-scenes facilitator of many of the most important pieces of legislation that now protect, preserve and conserve North America's natural heritage. Dan probably drafted more policy and crafted more testimony in support of major conservation initiatives than any person before or since. For four decades, he had an influential hand in every major piece of national level conservation remarkable and unparalleled achievement."

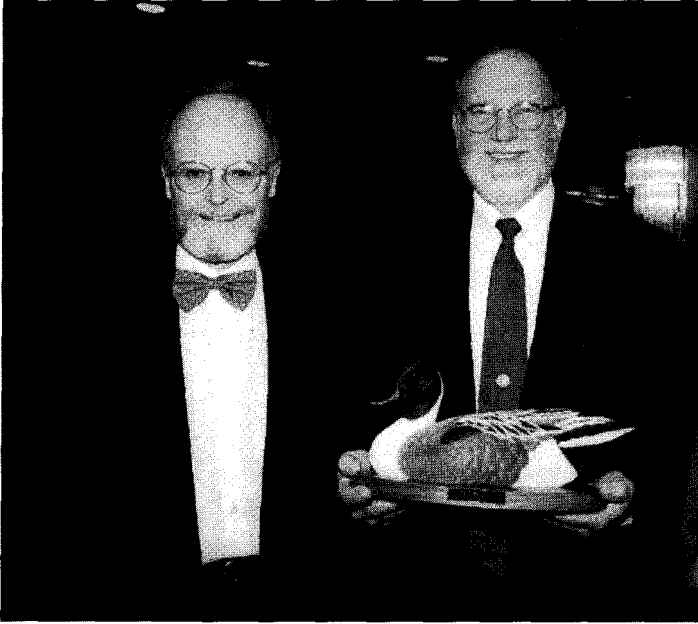


Rollin D. Sparrowe (left) presents the Wildlife Management Institute's 2003 Presidents Award to Alexander Brash, representing New York City's Urban Park Rangers Program.

New York City's Urban Park Rangers Receive Wildlife Management Institute's Presidents Award

The Wildlife Management Institute's (WMI's) Presidents Award specifically recognizes an agency's department, division, office or program for particular ingenuity, initiative and accomplishments that advance scientific management of natural resources in North America. The recipient of the 2003 award is the Urban Park Rangers of New York City's Urban Park Service. Staffed by more than 75 professionals and 250 volunteers, the Urban Park Rangers have management responsibility for 28,000 acres of city parkland, of which more than 10,000 are dedicated as "Forever Wild." In addition, the Rangers Program has reintroduced eastern screech owls to Central Park and bald eagles to the lower Hudson River area.

Presenting the Presidents Award to Alexander Brash, Chief of the City of New York's Urban Park Service, WMI President Rollin Sparrowe commented: "Providing special management in an urban setting has unique challenges as well as opportunities. It is easy for some of us to imagine restoring wildlife habitats or populations in a rural setting, but it is difficult even to conceive of doing so in a place such as New York City. Imagine the creativity and fortitude necessary to overcome that sort of bias."



Steve Weber (right), representing the Connecticut Lakes Headwaters Program, receives the Wildlife Management Institute's 2003 Touchstone Award from Rollin D. Sparrowe.

Connecticut Lakes Headwaters Partnership Receives Wildlife Management Institute's Touchstone Award

The Wildlife Management Institute's (WMI's) Touchstone Award honors a person, group or entity whose ingenuity and initiative result in a program or product that notably advances sound resource management and conservation in North America. The recipient of the 2003 award is the Connecticut Lakes Headwaters Partnership. The Partnership, created by U.S. Senator Judd Gregg and former New Hampshire Governor Jeanne Shaheen, is a coalition of conservationists, businesses, state and federal officials, and citizens that designed and effected a protection strategy for the Connecticut Lakes Headwaters Region—an area of 171,000 acres of forestland in northern New Hampshire. The diligence and creativity of its strategy paid off in acceptance by local citizens and interest groups and the acknowledgement of its ecological and economic soundness.

Said WMI President Rollin Sparrowe: "The protection strategy achieved through the Connecticut Lakes Headwaters Partnership sets a new standard of excellence for collaborative conservation." Steve Weber, Chief of Wildlife for the New Hampshire Fish and Game Department, accepted the award on the Partnership's behalf.

