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Conference Theme: Honing Conservation Imperatives: Insights and Foresights

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Contents

Opening Session.
Honing Conservation Imperatives: Insights and Foresights

Welcome and Opening Remarks

Steve Williams
Wildlife Management Institute
Gardners, Pennsylvania

Welcome to the 75th North American Wildlife and Natural Resources Conference. We thank you all for participating in and celebrating 75 years of a grand tradition, one that the Wildlife Management Institute is particularly proud of its role in and professional responsibility for. I would like to reinforce that this annual gathering is seen by us and, hopefully by you, not as a WMI conference, but as a professional resource management event. Our pride in the North American Conference is demonstrated by the accommodation of the needs, desires and opportunities for the community. As such, the North American will remain flexible in its format and scope. We will continue to invite and welcome your ideas for timely and meaningful special session and workshop topics and participants. Immediately following this conference, we will circulate an electronic survey to evaluate your experience here in Milwaukee and to enlist your suggestions for the 76th Conference and the 100th anniversary of WMI in Kansas City. Your input is important to us.

Historically, the plenary session's opening remarks have described the major conservation issues of the past year and identified current and emerging issues that we face. I will follow that tradition this year, but before I do, I would like to take a few moments to recognize the tragic loss of Sam Hamilton, the 15th Director of the U. S. Fish and Wildlife Service (FWS). Sam was an extremely personable, intelligent and dedicated fish and wildlife conservationist. He rose through the ranks of the Fish and Wildlife Service for more than 30 years to become the Director in 2009. His leadership ability to develop collaborative efforts and tackle complex issues was exemplary. One quick example–after two hurricanes ravaged the Gulf Coast, Sam called me, as then Director, to ask authorization to mobilize FWS employees and assets to the area to assist hurricane victims. This included vehicles, chain saws, fuel, generators, trailers loaded with water and ice, heavy equipment, and so on. After we discussed the potential legal issues, contracting rules and budget constraints, I agreed that it was worth the risk. Sam told me, "That's good because they are already there." His leadership and the work of the FWS staff was not only admirable but garnered widespread gratitude all the way from affected residents to the White House.

We talk about the fish and wildlife community as a family. I believe that to be true. Today, I ask you to join me in a few moments of silent reflection to honor the life of one of our family members, Sam Hamilton.

Sam's memory should cause all of us to dig deeper in our efforts to conserve our nation's fish and wildlife resources.

Last year was a tumultuous year for our nation and a very tough year for a new administration. Financial institution failures, unemployment, the recession, wars in Iraq and Afghanistan, climate change, divisive partisanship, and healthcare reform dominated the attention of Washington, D.C. On the conservation front, there was not much for which to be thankful. Climate legislation got mired down in politics and snowstorms. Comprehensive energy legislation did not have enough power to reach the President's desk, the National Fish Habitat Conservation Act was damned up, the future of the Clean Water Act revision is murky, hard rock mining legislation got the shaft this year, and the list goes on. Budgets for both federal and state resource agencies were reduced and staff levels cut back. We should look forward to 2010 if for no other reason than it is not 2009.

However, we should recognize that programs initiated in 2009 will be a conservation focus for this and the coming years. Climate change has been a driving force for the development of numerous initiatives. Government-wide, department-wide and agency-specific climate programs such as the U.S. Global Change Research Program consisting of 13 departments and agencies, the Department of the Interior's (DOI) Climate Change Task Force, Climate Change Science Program, U.S. Geological Survey's National Climate Change and Wildlife Research Center, FWS's National Fish and Wildlife Adaptation Strategy, Landscape Conservation Cooperatives, and many other programs at federal and state levels are poised to address climate change impacts and to consume staff and financial resources at an unprecedented rate. There is little doubt that climate change impacts will challenge fish and wildlife and their management like no other factor throughout this century and beyond. These programs will attempt to coordinate science information, research needs and management efforts across broad geographic landscapes and at local levels. They are necessary and important for our future.

I applaud the efforts of federal agencies such as DOI for their climate change initiatives: "New Energy Frontier," "Treasured Landscapes" and "Climate Change and Science Capacity." Congress has appropriated $400 million for Fiscal

Year (FY) 2010 for the departments of Interior and Agriculture, the Smithsonian Institution, and the Environmental Protection Agency. The FY 2011 President's Budget Request expands on this financial commitment. However, in our rush to tackle this most difficult challenge, we should consider the impacts on the past commitments and current needs of existing programs.

Because of budget constraints, the funding to carry out these new initiatives comes at the expense of existing programs. All new administrations inevitably establish new initiatives that promote the issues dearest to their hearts and constituents, we all know this, we have all been there. As the political pendulum swings, many traditional, heart and soul programs of agencies experience boom and bust cycles. Rarely is there "new" money around for new conservation initiatives. Budget decisions and language that touts "net increases" for certain programs but decreases funding for other existing programs should be examined carefully to make sure that in our haste to respond to long-term climate change, we are not endangering immediate meat and potatoes conservation work.

This certainly is not unique to the FWS, but its proposed budget does provide an example. Within the FY 2011 budget proposal, programmatic changes to the FWS's Resource Management Account are tied largely to DOI initiatives. The foundational programs of National Wildlife Refuges, fisheries, National Fish Hatcheries, migratory birds and law enforcement will endure budget reductions in order to fund those initiatives. Another example is reducing maintenance and construction dollars and increasing land acquisition. These decisions may make long-term sense, but they do not address the immediate problems associated with aging infrastructure.

Setting budget priorities is a science and an art, and I do not imply that current priorities are wrong. I do, however, question the sustainability of programs that suffer from inconsistent support even though their missions and mandates remain unchanged. As the entire federal government grapples with climate change, other departments and agencies are making similar difficult choices. These choices bear watching.

The fact that difficult choices must be made provides dramatic testimony for the need for new funding sources to deal with climate change impacts. Although climate change legislation remains mired at the moment, we must continue to advocate for conservation by advocating for adaptation funding. These "new" dollars must be secure and supplement, not replace, current funding, otherwise we are in a zero sum game.

Combine the need for global climate change adaptation with the continuing national demand for energy development, both nonrenewable and renewable, and you get a sense of the size and scope of the challenges facing our profession. Increased funding to support agency involvement in planning and consultation with the renewable energy industry is welcome and necessary. The question remains, will we use what was learned in the rush to develop oil and gas production to plan, permit, monitor and administer future oil, gas, wind and solar energy development projects? How will we manage the proliferation of energy transmission and distribution facilities that will be associated with geographically widespread renewable energy sources, and will play out, disproportionately, on public lands? Will fish and wildlife conservation get its money's worth from reprogrammed funds?

Another major emerging issue for 2010 is the initiation of national planning efforts. The U. S. Department of Agriculture recently announced the upcoming development of a new national forest planning rule. This collaborative process has been designed to consider the science behind forest management, sustainability of forest biodiversity, sustainability of rural economies and industries, wildfire prevention and management, watershed management, and forest and range management. The Landscape Conservation Cooperatives and National Fish and Wildlife Adaptation Strategy are similar collaborative efforts carried out by the FWS and its partner agencies. These processes are intensive and inclusive. The opportunities to engage in these monumental efforts are available and encouraged.

I will conclude by going back to my roots and the roots of our profession. One bright spot in the financial outlook of fish and wildlife conservation was the increase in excise taxes for the Federal Aid in Wildlife Restoration Program. Receipts for 2010 increased 38 percent over 2009, an increase of nearly $140 million. As you are aware, these funds are excise taxes collected from firearm, ammunition and archery manufacturers for products bought by hunters and shooters. The total projected excise tax funds for 2010 is $507 million for Wildlife Restoration and $478 million for Sportfish Restoration, a combined total of almost $1 billion. Combine these dollars with the fishing and hunting license revenue and other donations by anglers and hunters and you should understand the powerful financial and political impact of hunting and fishing.

That is why WMI, in conjunction with state and federal agencies and conservation organizations, has been providing leadership and coordination for the Hunting Heritage Action Plan to conduct comprehensive, national assessments of hunting recruitment and retention programs, hunting access programs, tax incentives for access, and liability and trespass statutes. It is why we secured a Multistate Conservation Grant to develop practical evaluation methodologies and training so agencies and organizations can objectively assess their efforts, measure performance and improve on their programs. That is why WMI, in conjunction with the Max McGraw Wildlife Foundation, has led the effort to educate university wildlife students and agency staff about the role and importance of hunters and hunting, the biological basis of hunting, hunting traditions and our nation's hunting heritage.

After the rough year in 2009, we do have reason to be optimistic. Major national efforts are underway to address climate change impacts, develop adaptation strategies, coordinate and deliver the science and research needed to provide for effective collaboration for management, and plan for the management of our national forest lands. We can make progress on an energy and climate bill that provides funding for adaptation, advocate for revisions to the Clean Water Act, and promote responsible renewable and nonrenewable energy development. We certainly have our work cut out for us. While we tackle these monumental tasks, let's not take our eye off the ball with respect to funding the basics of conservation, the work that forms our profession's foundation – the on-the-ground work that thousands of professionals conducted in the past and continue today.

Taking the Next Step

Dan Ashe
U.S. Fish and Wildlife Service
Washington, D.C.

This was supposed to be Sam Hamilton's speech. When we met several months ago to begin preparing it, Sam was asked, "When you're done speaking, what do you want the audience to do?" His response was classic Sam. He said, "I want them to clap." He spoke in jest, but thank you for making one of his wishes come true with your generous applause for his tribute video.

Sam Hamilton loved working with all of you. So, the video we just saw is a fitting beginning for this North American Conference, representing every state and federal conservation agency, and a "who's who" of conservation organizations and professional disciplines.

We have divisions and differences among us which we need to recognize and address, but we are *united* by our common mission to conserve wild places and wild things. And unity of purpose and effort has never been more important.

Without question, we are living in an era of monumental conservation challenges, including the loss and fragmentation of habitats, genetic isolation, invasive species, unnatural wildfire, water scarcity and illegal wildlife trade.

We know these challenges will be compounded by continued growth in human population and affluence, and by associated land and water use pressures. We know they will be magnified by the effects of rapidly changing climate.

These forces of ecological change operate with an exquisite but terrifying unity. These stressors are working together 24 hours a day, 7 days a week and 365 days a year.

At the same time, all of us feel stretched to the limit—in terms of budgets, in terms of time, in terms of uncertainties.

In these circumstances, we all know from history it is imperative that we work together, leverage our resources and concentrate them where they do the most good. Hope for the future of America's natural resources demands collective commitment to work through our differences and find better and better ways to work together.

All of us here share a great history of conservation successes. That heritage is a strength, but if we cannot unite against the crisis of our times, if we cannot harness a shared sense of purpose, vision and urgency for conserving fish and wildlife, then the future of our nation's wildlife heritage is at great risk. It's that simple. We could fail our predecessors, as well as our successors.

But we will not fail. Look around this room at the dedication, determination, experience and purpose represented here. Ours will not be a legacy of failure.

We know this because conservation has faced this challenge before. In the ecologically disastrous Dust Bowl, J.N. "Ding" Darling and his contemporaries looked for a permanent source of funding to preserve vanishing waterfowl habitat. By any measure, the Duck Stamp ranks as one of the most successful conservation initiatives in history. And it came about during the global economic turmoil of the Great Depression—a time when the risk of failure was incalculably high. Ding Darling and his contemporaries showed that times of crisis do not excuse failure of the imagination; they are a time for bold innovation, a time when problems are large and solutions must be larger.

In 1985, waterfowl populations were again facing crisis. Drought and the draining of wetlands were decimating habitat at the alarming rate of 60 acres per hour in the United States. The momentum was toward wetlands loss. But scientists and conservationists from inside and outside government united to envision the North American Waterfowl Management Plan. It was new. It required working together, strategically, addressing North American waterfowl goals in spatially specific partnerships. We are now familiar with the migratory bird joint ventures—private- and public-sector partners working together to conserve bird populations and habitats.

This is a model for science-based conservation. It unites us around common objectives. It allows us to understand the past, but manage to the future. It makes us better, because we are working not as states or feds or NGOs, but as partners.

Like Ding Darling and the Duck Stamp, like the architects of the North American Waterfowl Management Plan, conservation leadership is defined by the challenges we face and the way in which we face them. As conservation leaders we must acknowledge the challenge and consequence that we face, and we must embrace the change that is needed.

Courage to Change

When I think about change, I think about Charles Baxter, a slow-talking Texan whose gentle manner belied a fierce commitment to fish and wildlife conservation. Charles, a man many here called friend, was instrumental in how the U.S. Fish and Wildlife Service thinks about conservation.

Charles was trained in the traditional school of wildlife management. He became a field biologist and supervisor, and he was schooled well in the art of war against development and the U.S. Army Corps of Engineers. He came to realize,

however, that although he was winning isolated battles, he was losing the war. He realized that a tactical approach to natural resource challenges wasn't enough. A strategic vision and approach was required.

Charles had the courage to change. In the final phase of his career, he jumped on a new bandwagon and took a job as a something called a Joint Venture Coordinator. It made all the difference. Charles became not just a believer but a full-throated evangelist for collaborative science-based conservation. He became a leader and mentor for many of us. His influence has been enormous as we shift our conservation paradigm to focus on strategic landscape-scale conservation, working across program, regional, state and agency boundaries to define and pursue shared and explicit conservation objectives.

Charles once said that "One of the most powerful weapons you can ever possess in facing the uncertainties of life is having a sense of purpose." Charles passed away unexpectedly in early 2009, but the seeds of his vision and sense of purpose are scattered widely throughout the conservation community.

Sam Hamilton was one of Charles Baxter's disciples. Sam stepped forward as a visionary leader, calling for a transformation in how we think about conservation. He also remained loyal to our core relationships, constantly saying in regard to the FWS's relationships with its state fish and wildlife agency partners, "Let there be no daylight between us."

Sam was a son of the U.S. Fish and Wildlife Service, but he drew inspiration from his state colleagues: leaders such as John Frampton, Corky Pugh and Ken Hadaad. He loved you all, but I think he had a special place in his heart for Gary Meyers.

Sam admired Gary as someone who honors the past, yet never fails to embrace change when it is a pathway to great accomplishment. Someone who chooses not to focus on limitations and obstacles, but rather, on what must be done for fish and wildlife and how we can do it better, and who convinces both skeptics and supporters to join in new approaches, new partnerships, new successes.

Commitment and Leadership

Leading change requires both commitment and courage. I saw both in Sam Hamilton, but I didn't really appreciate how much until after his death.

Two days before he died, Sam shared a personal fact with several of us during a meeting in Golden, Colorado. He said that he was a direct descendent of Alexander Hamilton, and that he was, at the ripe old age of 54, the oldest surviving male in the Hamilton lineage. He leaned back in his chair, smiled that smirk of a smile, and said, "So you better be nice to me."

In hindsight, it was prescient; it was spooky. It gives me goosebumps to speak of it.

Obviously, Sam was aware of his family history, but all of us who knew him, know that he approached his life, work and play with full-tilt physical and intellectual energy. He didn't let it limit him or diminish him. He focused on the things that mattered. That's pure courage.

Sam's vision, commitment and courage are inspiration to those of us who knew him. He's gone, as is Charles Baxter, but their work is now with us, and it's in good hands.

Their vision permeates the Interior Department's strategy for tackling ecological stressors and climate change. It is grounded in sound science. It is grounded in an adaptive, landscape-scale conservation approach. And it is firmly grounded in collaboration with partners—not just collaboration in name, but collaboration focused on building essential, shared science capacity needed to respond strategically to the urgent problems before us.

Landscape Conservation Cooperatives (LCC) are a cornerstone to addressing the onslaught of natural resource stressors. Like the Joint Ventures (JV) on which they are modeled, LCCs are applied conservation science partnerships. Partners include federal agencies, state fish and wildlife agencies, tribes, NGOs, and universities within a geographically defined area.

The Joint Venture approach expanded from waterfowl to all birds. LCCs borrow from that construct to expand shared science capacity for all wildlife on the landscape.

Collectively, LCCs are designed to be a seamless national network of science planning and adaptive science capacity. They are capable of supporting site-specific protection, restoration and management efforts to help natural systems across the continent.

LCCs are partnerships—they are not owned by Interior, the FWS or any other single entity. State fish and wildlife agencies, tribes, conservation and environmental organizations, universities, and all our other partners will make these cooperatives come to life and share in their governance.

Working together, LCCs and U.S. Geological Survey Climate Science Centers will help integrate science and management expertise. This integrated approach will improve the ability of all of us to understand and forecast which resources are most vulnerable to the effects of climate change and other ecological stressors and how we can make them more resilient.

This shared science capacity will serve to expand the effectiveness and influence of State Wildlife Action Plans (SWAP), spatially connecting SWAP objectives, demonstrating common effort and accomplishment, and addressing key uncertainties through applied research. This shared capacity will embrace and further enrich the migratory bird JVs. This shared capacity will enrich the enterprise of Teaming With Wildlife. This shared capacity will enhance our Fish Habitat Partnerships.

We are also aligning with state fish and wildlife agencies and many other partners to develop a National Fish and Wildlife Climate Adaptation Strategy. Like a North American Waterfowl Management Plan for "all species," this climate-adaptation strategy will be a conservation community blueprint to guide wildlife adaptation partnership.

This effort is just beginning, and on behalf of this emerging partnership, you are invited to a special listening session this afternoon. Here is the chance to get in on the ground floor. And 25 years from now, someone who's addressing the plenary at the 100th North American Conference will be singing your praises.

There are also chances to get more information on LCCs and Climate Science Centers, with discussions scheduled in the Climate Change, Science and Research, Teaming With Wildlife and Business Committees. Much work needs to be done, and we need your involvement.

The National Fish and Wildlife Climate Adaptation Strategy, Landscape Conservation Cooperatives and Climate Science Centers are bold steps. They build on the many strong conservation partnerships all of you have helped forge. This room is full of leaders. You represent thousands. Let's bring them together and prepare them for the challenges that lie ahead.

After Sam's memorial service in Atlanta, Gary Myers walked up to me. Tears were piled against his eyelids, like floodwater against a levee. He grasped my hand, mustered a stiff smile, looked me in the eye and said, "We've got a lot of work to do. Don't let this slow the Service down."

There are lots of reasons to stop short. Sam's death is not one of those. Seek out anyone here who works for the U.S. Fish and Wildlife Service: you will see unity, and you will see determination. Seek out Gary Meyers and he will tell you what he told me.

There are lots of reasons to feel overwhelmed and discouraged. There's not enough money, not enough time, not enough science and there is way too much bureaucracy.

Each of us stands at the threshold of an uncertain future with imperfect tools and unfinished plans, but the storm is still coming. None of us has all the answers, but we can't let that slow us down.

Together we see more clearly. Together we find the courage and commitment to rise above fears and limitations and continue onward. Together we can find the hope and resolve to ensure that our children and future generations will share in the bountiful natural resources we've enjoyed.

Our predecessors inspire us, but they cannot walk our path. Our challenge is to take that next step. And for the sake of the resources we all love, and for the sake of our successors who will inherit the bulk of these challenges, let's step boldly, and let's step together.

Let there be no daylight between us.

Conservation and Continuity:
The North American Wildlife and Natural Resources Conference at Seventy-five (and Counting)

Curt Meine
Aldo Leopold Foundation and the Center for Humans and Nature
Baraboo, Wisconsin

As we gather on this special anniversary of the North American Wildlife and Natural Resources Conference, how can we make meaningful connections between a seemingly distant past, a troubled present, and an uncertain future? That question was on my mind earlier this week when I found myself in the library at the Department of Forest and Wildlife Ecology at the University of Wisconsin in Madison. At the top of one bookshelf was a box labeled "North American Wildlife Conference Transactions, 1937-1972." I did not have time to review all the volumes. And their contents are not yet available via the internet. (They should be. Then I could have gone on-line and stayed up until 2:00 a.m. in my hotel room preparing for this presentation!) But by chance I did pull out the *Transactions* of the 1963 conference. Toward the end of that volume you will find a paper entitled, "The Importance of History to Natural Resource Managers" by Charles Callison. (At the time, Callison was executive vice president of the National Audubon Society.) The article begins with a lament that, in 1963, only 15 years after Aldo Leopold died, students didn't know who he was any more. This was only a few years before Leopold's *A Sand County Almanac* was reissued in a paperback edition. That edition would itself change history.

A good portion of my own work over the years has been devoted to exploring "the importance of history to natural resource managers." Invariably, when I am asked to speak on the theme of conservation, history and the land ethic, I return to the events of the mid-1930s. It was a time, among other things, of revolutionary reconfiguring of this very conference. Think of the stories we have all heard and the images we have all seen of the Dust Bowl. Several of the images that especially come to mind are from "Black Sunday"—April 14, 1935, almost exactly 75 years ago—a day remembered for one of the most terrifying dust storms of the "Dirty Thirties."

Mark the occasion. April 27, 2010 is the 75th anniversary of the legislation that created the USDA Soil Conservation Service. I hope we will all take some time to celebrate it, perhaps by giving thanks for the soil that is beneath our feet and in our bones. I regard it as one of the most important events not only in conservation history, but in all of American and human history. It was one of many critical conservation developments of those years. Others included the founding of the National Wildlife Federation, the Wilderness Society and The Wildlife Society; the work of the Civilian Conservation Corps (CCC); and the expansion of the national wildlife refuge system. It was in fact the time when the one-word term *wildlife*, as we now use it, first became widely adopted.

These innovations came in response to the devastation of the American land, and the economic turmoil that was both cause and consequence of that devastation. The plowing up of the prairies and the recurring dust storms were only one expression of the crisis in conservation. It also entailed the near complete deforestation of the northern Great Lakes forest; pollution of waterways and the disruption of watersheds across the continent; widespread draining and ditching of wetlands; depletion of game populations and an increasing incidence of species endangerment and even extinction; environmental degradation in the nation's burgeoning cities; and of course, the pall of economic depression over it all. These comingled dilemmas of the 1930s brought forth what we can now recognize as dramatic change in conservation science, policy and practice. That change is reflected in the early transactions of this conference, in a wave of new laws and policies, in the letters and articles of the times, in the newspaper headlines of the day. Conservationists of all stripes knew in the mid-1930s that they faced an unprecedented situation, and that conservation had to evolve to meet the call of the times. They simply had to find new ways to think and work together to meet the multiple problems before them. There was no choice.

This response, of course, played out in many ways in many places. But to make a direct historical connection, I want to concentrate on one particular episode. In what we in Wisconsin fondly call our *west coast*, out along the Mississippi River, a lovely burbling trout stream flows amid the beautiful wooded hillsides, contoured crop fields and rolling pastures of the Coon Valley watershed. It was not always so pleasant a picture. In the early 1930s, it was a wasted watershed, vulnerable to gully-washing storms that had stripped much of the loess topsoil off its hills, deposited it thickly in the valleys and finally lost it to the Mississippi. Leopold described Coon Valley at the time as "one of the thousand farm communities which, through the abuse of its originally rich soil, has not only filled the national dinner pail, but has created the Mississippi flood problem, the navigation problem, the overproduction problem, and the problem of *its own future continuity*" [emphasis added].

That last phrase, I think, is simply a more poetic way of expressing the modern concept of *sustainability*. And it was in the Coon Creek watershed that a radical new approach to living sustainably on the land unfolded. Hundreds of farmers came together with the assistance of what was then called the Soil Erosion Service (predecessor to the Soil Conservation Service and today's Natural Resources Conservation Service) to establish the nation's first watershed rehabilitation demonstration project. Leopold and other experts from the University of Wisconsin and the newly mustered city boys in the CCC joined in the effort.

Shortly thereafter, in May 1935 (again, almost exactly 75 years ago), Leopold published an article about the project in *American Forests* called, "Coon Valley: An Adventure in Cooperative Conservation." In it, Leopold sought to communicate an essential message: to solve the problem of Coon Valley's "future continuity," the landowners and conservationists had to deal not only with the proximate symptoms of land degradation, but with ultimate causes. And to do that, they had to invent a whole new approach to conservation, one that encouraged all those involved to look beyond their own boundary lines and professional categories, to reconsider their special interest in this or that part of the land. They had to deal not only with the soils, or the water, or the pastures and crop fields, or the forests, or the wildlife, or the scenery, or the economic status and productivity of the land; they had to deal with all of them, together and simultaneously, within the entire Coon Creek watershed.

"There are two ways to apply conservation of land," Leopold wrote in his article. "One is to superimpose a particular practice upon the preexisting system of land use without regard to how it fits or what it does to or for other interests involved. The other is to reorganize, gear up the farming, forestry, game cropping, erosion control, scenery, whatever other values may be involved so they collectively comprise a harmonious balanced system of land use. The crux of the problem is to show that integrated use is possible on private farms, that such integration is mutually advantageous to both the owner and the public." Leopold used that word *integration* several times in the article. He also used the words *community* and *cooperation*. In so using them, Leopold was not criticizing the highly individualistic Norwegian farmers of Coon Valley (whose adaptability he greatly admired). Nor was he overlooking the particular parts of the land community. Rather, he was conveying the need to make connections on the landscape so that all might flourish together, in a manner that did not undermine, but bolstered, the resilience of the land.

I tell the story of Coon Valley because it serves so well as a proxy for the times in which this conference was transformed. What do we learn from those events of 75 years ago? I ask because, if we are honest with ourselves, we must recognize and admit that we have been slow to learn and apply many of those lessons. Let me offer three core lessons that I at least have taken away from the history of "the worst hard times" (as Timothy Egan titled his recent award-winning book on the Dust Bowl).

First, the 1930s taught us in a profound way that the fate of human communities and natural communities is intimately interconnected. For those of us who work in conservation, that is basic knowledge and maybe even plain common sense. But it was not for the public then, and it is not now. It was a lesson that forever marked that generation of conservation scientists, policy makers, educators and practitioners. It was one, however, that would fade in and out over the decades that followed, depending on the length of time since the most recent environmental crisis pointed out its essential truth, and the speed with which that crisis faded from the headlines and into the past.

Second (and I say this with writer and farmer Wendell Berry in mind), we conservationists need to speak loudly and boldly some fundamental truths about our economic philosophy and the system of economic, educational and policy institutions that embody that philosophy, because, quite frankly, we cannot count on traditional economists to do it. Leopold, commenting on the problem of soil loss and watershed degradation early in his career, in the American Southwest, wrote: "Erosion eats into our hills like a contagion, brings down floods and the loosened soil upon our valleys like a scourge—water, soil, animals and plants—the *very fabric of prosperity*, react to destroy each other and us" [emphasis added]. Later, in his essay "Wildlife in American Culture," he would distill his emerging economic wisdom into a deceptively simple sentence: "We fancy that industry supports us, forgetting what supports industry."

On my dark days I fear that we have learned nothing from the last two years of tectonic economic change—that we are well on the way to having wasted this crisis. Worse yet, I fear that we in the conservation community have had no voice in this conversation, that we have failed to bring to the table our necessary perspective, using our generations of accumulated knowledge and wisdom. Up until the very brink of the recent economic near-meltdown, pronouncements came forth over the airwaves and from the highest offices in the land—and not just government or business offices—that "the fundamentals of the economy are strong." Now that we have stepped back (at least for the time being) from the brink, we are anxiously awaiting the word from our economists and from the pundits' pulpits that the fundamentals are strong again! But we here in this room, and our fellow conservation-minded citizens, we are the ones who know in our bones that "the fundamentals of the economy" are not abstract numbers on the computer screens and spreadsheets of the world, not the subtotals toted up at the end of economic formulae. These do not constitute the bottom line. The true "fundamentals of the economy"—of all human economic activity, everywhere, all the time—are in fact *the soils, the waters, the plants and animals, the atmosphere and oceans, and fellow citizens of our communities, the nation, and the planet.* It is up to us

here—if we do not, *who will*?—to speak up and speak out, to point out these basic economic truths, and to challenge ourselves, our colleagues, our fellow citizens, our leaders, and especially our children to imagine and create an economy that does not exist merely to consume, but to sustain, the land; that does not deplete resources and move on, but that restores and renews healthy ecosystems and human communities; that rewards rather than penalizes stewardship and caring and conserving. That was the conservation challenge of the mid-1930s. It remains ours today, *in extremis.*

And this suggests the third lesson from the 1930s: that we cannot solve any one of our multiple conservation and environmental problems in isolation. Solutions to any one of our dilemmas must also contribute to solving all the others. That is what the watershed approach showed. Coon Valley was a troubled place, not just in terms of its soils, or waterways, or woodlands, or wildlife, or farms. It was all of those and more. In the 1930s at Coon Valley, and in a thousand other places like it, the solution required that all the conservation needs be addressed together in the same place, within the same watershed, in a coordinated and integrated manner.

Now we find ourselves again in a time of national and global economic turmoil, even as we face what we might call The Litany of Woe—the many daunting problems that we face: climate change, human population growth, dwindling fossil fuel supplies, biodiversity loss, emerging diseases, declining freshwater quality and quantity, food security… all those dark trends that keep us up worrying late at night. We have every good reason to shudder when we look straight at the Litany of Woe and at our human prospects a generation or two out (much less seven generations). Yet, we still seek simplistic solutions (think, just to choose one example, of the recent corn ethanol mania). We fail to think like conservationists: to make connections among our concerns; to support and use our best science; to weigh long-term costs and benefits; to consider ultimate causes and durable solutions; to care about our neighbors, future generations, other species and the land as a living community. We are relearning what those who started this conference had to learn in the 1930s: the absolute necessity of coordination and integration in service of our shared interests, of pulling together toward a common cause. Our predecessors might not understand the way we talk about it today—promoting positive synergies, changing our paradigms, achieving win-win solutions and so on. But we face the same need. We need to design conservation policies and programs and practices so that solutions to any one problem help to solve all the other problems simultaneously. When I'm feeling really severely academic, I say it this way: *systemic problems require systemic solutions*. Wendell Berry describes it more poetically as "solving for pattern," that is, addressing each problem not in isolation, but as related expressions of troubled relationships.

And so when the dust of the 1930s had literally settled, a new generation of conservationists had learned the hard way lessons that would be relevant to all future generations: that our human communities are fundamentally dependent on natural communities, even as both undergo constant change; that conservationists have a particular responsibility to speak this truth and to point out that our economic welfare reflects the health of the ecosphere in all of its dimensions; and that achieving sustainable relations with and within a healthy natural world requires integrated, caring responses at all levels of human society.

Looking back now across three generations and 75 years, why were some of these lessons remembered and others forgotten? Why and how did the emergence of modern environmentalism alter them? How have these notions fared in the never-ending whitewater churn of political change? I hope we will have more time in the days ahead in our hallway conversations to discuss those questions. But in the remainder of my time, I want to offer a challenge and a hope. I am often torn apart, as I suspect many of you are, by the Litany of Woe. But then I wake up another day and recognize that there is also a Litany of Hope. When we look back especially over the last 20 years, we can take some justifiable pride in how conservationists have begun to think in new, different and utterly necessary ways, and how we have begun to act on that knowledge.

I have had occasion recently to review some of those positive developments. I have been writing a new introduction for a forthcoming new edition of my 1988 biography of Aldo Leopold. In so doing, I have been looking back over the last generation in conservation. I could honestly conclude that, however daunting our challenges have become, we have also seen essential changes in the way we think about and do conservation. You have already heard reference to many of these trends in other presentations this morning: the shift to landscape-scale approaches; the increased focus on working lands and private land conservation (which was sorely lacking 20 years ago); the emergence of ecological restoration and community-based conservation projects; the development of ecological economics and new ways of valuing ecosystem services; the "greening" of religion and philosophy. We could add other trends to the list, this Litany of Hope. Whether these changes will come fast enough and go far enough is up to us. So let us keep in mind the words of David Orr, our good colleague from Oberlin College in Ohio: "Hope is a verb with its sleeves rolled up."

As we turn to the future, let us ground ourselves. Let me take you to two places here in Wisconsin where I find hope as a conservationist these days. One is right back there along the Mississippi River in western Wisconsin: Coon Valley and its neighboring watersheds. If not fully healed, the land has recovered dramatically since the 1930s. You can indeed find plenty of good hunting and fishing and birding and scenery in Coon Valley. But you will also find that the hills and valleys of Wisconsin's beautiful Driftless Area have become a hotbed (literally!) for local and organic

agriculture. If you examine a map of the nation's certified organic producers, you will see quite a swath across the upper Midwest, with Coon Valley right at the epicenter. Nearby La Crosse, Wisconsin, has hosted an annual gathering of the Midwest's organic growers every February since 1989. That first meeting drew a few dozen people. This year, 3,000 people attended. In fact, it is no longer advertised as a Midwestern meeting; it has become the *de facto* national meeting of those exploring and inventing new ways to produce healthy food from healthy land.

What this signifies to me as an historian of conservation is that agriculture and conservation are coming back together in a way that we have allowed to wither over the last two generations. We can see this not only in Wisconsin and the Upper Midwest, but across the country in the growth of the local food movement, in the popularity of farmers' markets and community-supported agriculture, in the increased commitment to childhood health and nutrition. Food is reconnecting people from cities, suburbs and rural communities to each other and to the land. New and creative links are being forged in ways that support local farmers, economies, and communities, public health, education, and land stewardship. Through food, we are trying—and able—to solve multiple problems simultaneously.

The second spot is just a few miles away from where we are right now, on the north side of Milwaukee, on Silver Spring Road. There you will find what from all outward appearances is unremarkable: the non-profit organization Growing Power. There, Will Allen and his team hold forth. Last year, Will was recognized with a MacArthur "Genius Award" for his innovative work in urban agriculture, reconnecting his neighbors to food and soil and water, offering basic lessons in ecology and resource stewardship to communities that had been neglected, reviving food and cooking traditions, providing fresh food in neighborhoods where fresh food is often unavailable. Will Allen is an amazing fellow. I encourage you, if you have time while here in Milwaukee, to visit Growing Power and see what goes on there. I guarantee that you will find hope there (and, I bet, a few samples of fresh greens).

And so, on Wisconsin's rural west coast in La Crosse and Coon Valley, on our urban east coast here in Milwaukee, and in many other places in between, our land ethic is growing and changing. It is being reinvented and extended by new generations in new places. And of course, these are only two examples from here in Wisconsin; in fact, we can find them everywhere when we look. Our imperative need is to hold these places up, to make connections and common cause across the landscape with others who care about the health of the land, all its inhabitants and functions, and the well-being of its people. We may have different immediate priorities. We may come from different backgrounds. We may care about the land in different ways. But we all care enough to act on that concern in imaginative and meaningful ways.

In 1940, Aldo Leopold observed, "Conservation viewed in its entirety is the slow and laborious unfolding of a new relationship between people and land." (I sometimes add, when I recite that sentence these days, "You know, Aldo… we've *got* to be a little more *fast* and laborious!") From that difficult period in our history we can take this vital lesson: that generation faced multiple crises and emerged from them with the shared commitment to the greater conservation good, to land health and to resilient human communities. The people who organized this conference 75 years ago did so under dire circumstances, with social, economic and ecological disaster playing out across the land and war clouds on the horizon. They had to confront some basic, uncomfortable truths about history and economics and about our deficient record as keepers of the land and creators of wealth.

Not all their responses were right or lasting, but among the fruits of that time was a deeper vision of humanity's role and responsibilities within the natural world. Aldo Leopold's term for that vision was "the land ethic." When in 1947, he composed the essay "The Land Ethic," he included this key passage—the most important words he ever wrote, in my view: "I have purposefully presented the land ethic as a product of social evolution, because nothing so important as an ethic is ever 'written.' …It evolve[s] in the minds of a thinking community." Consider exactly what Leopold was doing in that passage. Leopold, in writing "The Land Ethic," points out that an ethic can in fact *never* be written; that this was only his best effort to define it at the moment. He was calling upon you and me, upon all of us as a community, to "write" the land ethic, to draw upon our diverse experiences and knowledge and traditions and wisdom to build that ethic. In other words, all of us, in effect, write the land ethic every day.

This conference was first held 75 years ago, providing a critical venue for the "thinking community" of conservationists. None of us knows whether this conference will even be held 75 years from now. We cannot know what our grandchildren and great-grandchildren will say about what we do here. I feel pretty confident that they will take a look back and pass some kind of judgment. Let us hope that our grandchildren are generous and forgiving. Let us also, however, work to earn their respect and gratitude by demonstrating that we are contributing to a still-evolving conservation ethic; that we can rise above our differences and circumstances and look beyond our immediate self-interest; that we responded with hope and at least some wisdom to the profound challenges and opportunities we face right now. For how we respond to those challenges will shape the way that they live and the world that they live in. Let us pause in this moment to remember the debt that we owe to our grandparents and the effort that we owe to our grandchildren.

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Special Session One.
Ecosystem Service Markets: Funding Tools for Conservation

Ecosystem Services and North American Conservation: Setting the Context

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The ecosystem services framework is a concept that is rapidly rising in importance in conservation efforts across North America and the world (Daily et al. 2009). From the boardrooms of private corporations to strategy meetings run by public agencies to outreach programs with farmers, ranchers and foresters – there is growing interest in the ecosystem services framework and what it might deliver in terms of a new and complementary approach to stewarding North America's wildlife and natural resources. The purpose of this manuscript is to set the context for the special session titled "Ecosystem Service Markets: Funding Tools for Conservation." This manuscript is structured as follows. First, we describe the escalating pressures on wildlife and natural resources that are motivating the development of new strategies and tools for conservation. Second, as one important new approach, we provide a general overview of the ecosystem services framework. Third, we introduce a major new incentive tool for conservation: developing payment programs and markets for ecosystem services. Fourth, we describe emerging lessons about the strengths and limitations of using ecosystem services as a tool for conservation. Finally, we conclude by providing a segue to the talks that were a part of this special session.

Diverse payment programs and markets for ecosystem services are already in operation and many more are in development (Hamilton et al. 2010, Madsen et al. 2010). These programs hint at a substantial pool of untapped funding, resources and human capital that could be used to support and diversify strategies for conservation across North America. At the same time, there are active voices of concern about using market-based mechanisms as a tool for conservation. Given the dynamic and evolving context surrounding ecosystem services, the pressing question before us is how to mobilize these opportunities to ensure maximal benefit for wildlife and natural resources, while also being highly attentive to potential pitfalls. In this special session, we explore this question concretely through perspectives and case studies that span the public, private and nonprofit sectors to begin understanding how an ecosystem services approach could contribute meaningfully to conservation efforts across North America.

Mounting Pressures on Wildlife and Natural Resources

Profound changes in population size and land use across the world are placing unprecedented pressures on our planet's natural capital, including resources related to land, air, water and wildlife, which contribute directly to human well-being (Foley et al. 2005, Millennium Ecosystem Assessment 2005). More than ever before in history, there are competing demands from land related to policy goals for food security, energy security, climate change, and wildlife and natural resources conservation (Tilman et al. 2009).

For projects on public and private lands, challenges to realizing effective stewardship are complex, connected and constantly shifting in nature. Examples of key threats include the following (and many other factors). First, approximately 40 percent of the global land surface is currently devoted to some form of agricultural land use, and the pressures on existing agricultural lands continue to increase with growing population, rising per capita incomes and shifts in dietary preferences (Foley et al. 2005). As a result, market and political forces are driving the continued conversion of native prairie, forests and other ecosystems for food and energy production, as well as intensification of existing agricultural lands to meet rising demand (Fargione et al. 2008, Searchinger et al. 2008). Second, lands devoted to human settlement are also rapidly expanding with direct and indirect impacts on wildlife and natural resources (Maestas et al. 2003). More than 3 million acres per year of private land are being developed and urbanized (Macie and Hermansen 2002). Furthermore, over the coming decade and a half, Theobald (2005) estimates that exurban areas will expand to nearly 15 percent of privately owned land in the continental U.S. Importantly, residential development is expected to continue encroaching upon protected areas, directly affecting the conservation value of parks and the connectedness of core protection areas (Wade and Theobald 2010). Third, as evidence of the impacts of climate change on wildlife populations and natural resource stocks continues to grow, managers and policymakers are increasingly planning for resource

management in the context of uncertainty about future climatic conditions (Heller and Zavaleta 2009, Mawdsley et al. 2009). Finally, concerns about energy security and climate change are pushing the development of low-carbon energy sources such as biofuels, wind, solar and others. While these switches in energy sources can contribute importantly to policy goals for climate and energy, there is also growing evidence that these energy sources, in certain contexts, can have unintended detrimental impacts to wildlife and natural resources (Tilman et al. 2009).

These challenges and many more are perhaps all too familiar to resource managers and policymakers focused on North American conservation. With these challenges as the motivating context, our goal in this special session was to provide practical guidance about the strengths – and potential limitations – of using an ecosystem services approach to expand the influence of conservation dollars and policies toward achieving measurable outcomes for land, water, air and wildlife.

What are Ecosystem Services?

To establish a common framework, we define *ecosystem services* as the benefits that people derive from nature that support and fulfill human life (Millennium Ecosystem Assessment 2005). These benefits are many and include, for example: beautiful landscapes and wildlife, which provide opportunities for recreation, hunting and eco-tourism; insects which pollinate many crops that provide food and nutrition; and trees which sequester and store carbon helping to stabilize the climate.

More broadly, we can group the full suite of ecosystem services into four categories, as defined by the Millennium Ecosystem Assessment (2005): (1) *provisioning services* (also referred to by others as ecosystem goods) such as food, water and timber; (2) *regulating services* such as processes by which forests and other ecosystems help to regulate the climate or purify water that passes through them; (3) *cultural services* such as recreational and educational activities, and the aesthetic and spiritual fulfillment we get by connecting with nature; and (4) *supporting services* which are needed to support the production of services in the preceding three categories, such as nutrient cycling, soil formation and net primary production. Of these four categories, economic markets have developed most robustly for provisioning services and some cultural services (e.g., recreation), but are largely lacking for the remaining services.

Ecosystems as Capital Assets

Just as concerns about growing exploitation and scarcity of wildlife motivated individuals like Theodore Roosevelt, Aldo Leopold, George Bird Grinnell and many others to develop a new model for wildlife and habitat stewardship in North America in the previous century, so are escalating concerns about the persistent and emerging threats to wildlife and natural resources driving today's leaders to ask questions about the efficacy of current approaches and the need for new ones. What is evolving is a new paradigm about how we think about wildlife and natural resources and the critical role they play in sustaining and fulfilling our lives. This new paradigm views ecosystems as capital assets – assets which, if managed correctly, will provide a stream of benefits today and into the future (Turner and Daily 2008).

To motivate this concept, consider, for illustrative purposes, a parcel of forested land. From an economic perspective, the primary financial value of a forest generally results from the extraction of timber, and in some cases, there are complementary market opportunities, such as grazing cattle in the understory in a silvopastoral system. While timber and other marketable commodities are important factors driving forestland management, forests supply many additional benefits to humans. Examples of such benefits include providing habitat to support wildlife, contributing to climate stabilization, aiding in the removal of nutrients and pollutants for drinking water, and many others. Historically, these non-extractive benefits have not had formal value recognized by markets. As such, there are not direct incentives that reward landowners for providing these benefits to society (Heal 2000).

Recognizing that there are "missing markets" for many environmental resources that contribute to the public good, leaders across the public, private, nonprofit and academic sectors are working together to develop new financial and institutional mechanisms that will better align private and public goals in land management. These new approaches are being piloted across the world, and we briefly describe three projects to highlight the range of conservation contexts being addressed. First, in 1997, Costa Rica launched the world's first payment program for ecosystem services, and this program continues today. As one of its main components, the program compensates landowners for forest conservation to protect four valuable ecosystem services: biodiversity conservation, climate regulation, hydrologic services, and scenic beauty for recreation and ecotourism (Pagiola 2008). Second, another pioneering project comes from New York City where, in the late 1980s and early 1990s, the city was facing a tough decision. Water quality for the city's residents was becoming increasingly degraded, and the water was no longer meeting standards set by the Environmental Protection Agency. Much of the problem was coming from sewage, fertilizer and pesticides being used in the Catskills watershed north of the city. To address these concerns, New York City made a bold decision to invest in improved land management practices and

land protection in the watershed rather than the more traditional approach of building another water filtration plant. In doing so, economists estimate that this investment in natural capital saved the city on the order of $4.5 to 6 billion (Chichilnisky and Heal 1998). Finally, and directly related to wildlife, a new mitigation banking program is just being launched in Utah to pay farmers and ranchers to protect Utah prairie dogs (*Cynomys parvidens*) on their property as an offset (involving a net benefit to the species) for impacts from land development. In doing so, protected habitat on private lands will contribute to recovery efforts for this federally listed species. Notably, this program involves collaboration between a diverse range of key stakeholders including the U.S. Department of Agriculture, Environmental Defense Fund, the Utah Farm Bureau Federation and others (Stark 2010). All of these programs, from New York City to Costa Rica to Utah and beyond, are united by a common goal: recognition of the benefits that can be generated by providing tangible rewards to landowners who steward public natural resources.

Payments for Ecosystem Services: An Introduction

Broadly speaking, these new incentive-based tools can be considered *payments for ecosystem services*, which we define as follows based upon Engel et al. (2008: 664): "a *voluntary* transaction where a well-defined *environmental service* (or a land use likely to secure that service) is being 'bought' by a (minimum of one) *service buyer* from a (minimum of one) *service provider* if and only if the service provider secures service provision (*conditionality*)." (For our purposes here, we note that the terms 'ecosystem service' and 'environmental service' are synonymous). In essence, payments for ecosystem services establish a formal link between those who benefit from the provision of an ecosystem service (e.g., carbon sequestration and storage to promote climate regulation) and those who supply the service (landowners) through their land management. While a simple concept, these economic and institutional links are currently missing for many ecosystem services (except, as noted above, for provisioning services and some cultural services, such as recreation). Accordingly, one of the primary goals of payments for ecosystem services is to establish relationships between users and providers where they currently do not exist and where there can be mutual benefit. Recalling the illustrative parcel of forest discussed earlier, we noted that this forest supplies an array of valuable, yet generally uncompensated for, ecosystem services to society such as wildlife habitat, climate regulation and watershed services. Payments for ecosystem services establish a revenue stream, paid for by beneficiaries and received by landowners, to help ensure that there is an incentive for these services to continue to be supplied in the future. For example, a residential developer might pay a landowner to protect habitat for an endangered species through a mitigation bank; a power plant might pay a landowner to enhance carbon storage on his or her land to promote climate regulation by offsetting the plant's greenhouse gas emissions; and a bottling company might pay a landowner to establish riparian buffers to reduce nutrient loading into streams. While each of these cases involves the buyer purchasing one specific service, in some cases (though certainly not all), payments for carbon sequestration and storage, for example, may also capture co-benefits for protecting wildlife habitat, aesthetic values or other non-purchased services. This situation occurs when multiple ecosystem services are co-produced through the same management activities meaning that a payment for one service can act as an 'umbrella' to capture co-benefits (Turpie et al. 2008). Determining when this 'umbrella' effect will occur is an active area of research with direct policy implications (Tallis and Polaksy 2010, Nelson et al. 2009).

Given the growing number of payment programs for ecosystem services, it is helpful to categorize them into broad, representative groupings. Based upon extensive market research, Forest Trends and the Ecosystem Marketplace jointly published a report in 2008 titled "Payments for Ecosystem Services: Market Profiles. his report, which provides a snapshot in time of a constantly evolving market landscape, provides two complementary ways to categorize existing markets: first, by the type of ecosystem service commodity, and second, by the payment type (Forest Trends and the Ecosystem Marketplace 2008).

In terms of commodity types, there are four categories (Forest Trends and the Ecosystem Marketplace 2008). First, *carbon markets*, which reward the stewardship of an ecosystem's atmospheric regulation services – specifically, the absorption of carbon dioxide from the atmosphere; examples of existing markets include the Chicago Climate Exchange and the Clean Development Mechanism through the Kyoto Protocol. According to a recent report, a minimum of $149.2 million has been transacted to-date for forest carbon offset credits, with the larger set of carbon markets trading in the billions of dollars (Hamilton et al. 2010). Substantial growth is expected to continue. Second, *water markets*, which provide payments for nature's hydrological services related to water quality, quantity, location and timing; the New York City project described above provides an example here. Third, *biodiversity markets*, which create an incentive to pay for the management and preservation of biological processes, as well as habitat and species. The Utah prairie dog mitigation bank described above provides an example here. According to a recent report, there is currently a minimum of 119 species banks operating in the United States with an estimate of at least 600 banks operating globally. Financial information was only available for about one-fifth of these banks, but a lower-bound estimate of the financial value of these markets was

set at $1.8 to 2.9 billion per year (Madsen et al. 2010). Fourth, *bundled payments*, which secure all or a combination of carbon, water and biodiversity services. Examples include eco-certified products such as timber and coffee.

In terms of payment types, there are three categories (Forest Trends and the Ecosystem Marketplace 2008). First, *compliance markets*, which are driven by regulation and enforcement, similar to other pollutant trading markets (e.g., market for sulfur dioxide emissions); the Clean Development Mechanisms through the Kyoto Protocol provides an example in the context of carbon markets. Second, *voluntary markets*, which are driven by ethical and/or business-case motives. In many cases, the threat of future regulation also drives these markets; the Chicago Climate Exchange provides an example of a voluntary carbon market. Third, g*overnment-mediated markets*, which involve publicly administered programs that use public funds to pay private landowners for the stewardship of ecosystem services on their property. Costa Rica's national payment program for ecosystem services described above provides an example for this last category.

Emerging Lessons Learned from Existing Payment Programs for Ecosystem Services

With substantial dollars being invested globally in ecosystem service programs, there is a rising wave of expectations being placed on this approach, including the incentive-based tools, to mainstream conservation into management and policy decisions. Indeed, ecosystem services are entering the conversation and toolset of public agencies (e.g., U.S. Department of Agriculture, Environmental Protection Agency), major conservation NGOs (e.g., The Nature Conservancy, World Wildlife Fund, Conservation International) and private sector corporations (e.g., Corporate Ecosystem Services Review from World Resources Institute, Hanson et al. 2008). In the U.S., ecosystem services were integrated into The Food, Conservation, and Energy Act of 2008 (commonly known as the Farm Bill). In particular, Section 2709: Environmental Services Markets states that "The Secretary shall establish technical guidelines that outline science-based methods to measure the environmental services benefits from conservation and land management activities in order to facilitate the participation of farmers, ranchers, and forest landowners in emerging environmental services markets" (available at: http://www.fs.fed.us/ecosystemservices/pdf/farmbill/HR2419.pdf). To help facilitate development of these markets, the U.S. Department of Agriculture launched in December 2008 a new Office of Ecosystem Services and Markets, which was recently renamed Office of Environmental Markets.

In the two sub-sections that follow, we provide an initial list of potential strengths and drawbacks of using an ecosystem services approach to expand the effectiveness of conservation efforts across North America. This list is based on analysis of existing projects in the literature, but it is brief and not meant to be comprehensive. Rather, we point readers toward the cited references and the other manuscripts in this special session for insights derived in the context of specific projects and sectors (public, private and nonprofit).

What Might an Ecosystem Services Approach Provide to North American Conservation?

We highlight three benefits that adopting an ecosystem services approach could provide for public, private and nonprofit groups contributing to conservation efforts in North America. First, developing projects focused around ecosystem services may provide access to new and more diverse funding sources than traditional conservation approaches (Goldman et al. 2008). This is a notable initial finding given that funding for conservation is almost always a limiting factor at local, state and national levels. Importantly, rather than being a zero-sum game where funds allocated to ecosystem services projects come only through redistribution from traditional projects, funding for conservation can be expanded by adding an ecosystem services focus (Goldman et al. 2008). In particular, Goldman et al. (2008) found that ecosystem services projects were significantly more likely to obtain private, for-profit corporate funding (e.g., energy companies, bottling companies) and that corporate funding contributed a significantly greater percentage of the total project budget. Furthermore, the researchers found that ecosystem services projects drew upon a significantly greater number of revenue sources overall. In a complementary analysis, Goldman and Tallis (2009) found that there was no difference between traditional projects and ecosystem services projects in terms of the level of investment in social tools that ensure longer-term adoption of conservation efforts in project regions. Based upon this result, they conclude that there is no reason to expect ecosystem services projects to be more dependent than traditional projects upon volatile and short-term financing mechanisms (a concern discussed below).

Second, adopting an ecosystem services focus has the potential to broaden the support base for conservation by reaching out to new constituencies. Goldman et al. (2008) found that ecosystem services projects were significantly more likely than traditional approaches to target private landowners and working agricultural lands. Finding practical strategies to harmonize conservation with agricultural production on private, working lands is a key challenge in North America and globally (Fischer et al. 2009), and payments for ecosystem services may provide one tool to create profitable, integrated conservation-production business models for landowners (Goldstein et al. 2006). In addition to engaging private landowners in conservation, payments for ecosystem services also directly target ecosystem service users. These users

provide funding for payment programs, but there may also be potential to mobilize their support more broadly, economically and politically, to advance conservation efforts.

Third, adopting an ecosystem services focus may provide a platform from which to partner with a broader set of public, private and nonprofit institutions and develop a more effective coalition supporting conservation projects. For many existing programs, this ability to engage a wide range of stakeholders, including some that historically have been at odds with conservation efforts, is a key strength of ecosystem services projects (e.g., Stark 2010, Bohlen et al. 2009).

But are We "Selling Out on Nature"?

Balancing the excitement and resources moving into ecosystem services projects are concerns that this approach, and particularly incentive-based payment schemes, will lead to "selling out on nature," as stated by McCauley (2006) and reinforced by Redford and Adams (2009). Amongst multiple concerns, we briefly discuss three concerns that are directly relevant to this special session. First, markets are known to exhibit boom and bust cycles, and critics argue that it would be both irresponsible and ultimately ineffective to put conservation values at risk of liquidation when economic downturns occur. Not surprisingly, this issue is at the forefront of many people's minds given the recent and ongoing global financial crisis. As such, there is renewed discussion about safeguards that can be built into ecosystem service markets to minimize the risk that natural capital is liquidated during downturns or other market-mediated factors.

Second, critics are asking the question about whether payments for ecosystem services will lead to healthy natural communities or whether the current one-service focus of most markets will continue to perpetuate distortions in land management. Much of this concern is being voiced with carbon markets, as these are generally the most mature of all ecosystem service markets. Indeed, research has shown that tradeoffs between carbon sequestration and other ecosystem services (e.g., wildlife habitat, hydrologic services; Jackson et al. 2005) could play out on the landscape. Given this, will payments for carbon sequestration incentivize landowners to optimize for carbon-driven revenue, while still retaining a blind spot to negative impacts on other ecosystem services, when such conflicts exist? As discussed earlier, this concern gets at a fundamental issue of the degree to which multiple ecosystem services will be co-produced through incentivized land uses and management practices versus result in trade-offs.

Third, critics have stated that the rapid growth of payment programs for ecosystem services is occurring in a context where adoption of this approach is outpacing rigorous justification and measurable results. Based upon this concern, Redford and Adams (2009) stated that "Conservation has a history of placing great faith in new ideas and approaches that appear to offer dramatic solutions to humanity's chronic disregard for nature (e.g., sustainable development, community conservation, sustainable use, wilderness), only to become disillusioned with them a few years later." Indeed, we concur that critical examination of and reflection upon the successes and failures of payment programs for ecosystem services will be needed to ensure that this approach delivers upon its promise.

The Path Forward

The ecosystem services framework provides a new and potentially catalytic strategy to address the multifaceted challenges confronting wildlife and natural resources conservation in North America and throughout the world. The incentive-based tools that are being advanced, broadly termed *payments for ecosystem services*, present an opportunity to create tangible financial resources and supportive partnerships to enable active stewardship of resources related to land, air, water and wildlife. At the same time, the momentum building behind these payment programs must be balanced by the critical understanding – based upon real-world experience to-date – that this approach is not a silver bullet to solve all problems (Landell-Mills and Porras 2002). Determining where payment programs for ecosystem services can be most successful in supporting the management and policy goals of natural resource and wildlife agencies, conservation NGOs, private sector companies, and other interested parties is a key challenge ahead. The presentations in this special session provide a snapshot in time of the rapidly evolving field of ecosystem services. The case studies draw upon projects from throughout North America to provide a wide range of perspective cutting across multiple economic sectors – public, private and nonprofit, as well as multiple ecosystem service markets – carbon, water and biodiversity. Through these case studies, we aim to demonstrate concretely how the ecosystem services framework and payments for ecosystem services can deliver positive benefits for wildlife and natural resources. As the ecosystem services toolbox continues to develop, one thing is for sure: maximizing its potential requires all players to be actively involved, including public agencies, NGOs, private sector, philanthropic foundations and academic researchers. We invite you to be a part of this conversation and shape the way forward.

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Ecosystem Service Markets:
Private Sector Views About Opportunities for Private/Public Partnerships

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To keep every cog and wheel is the first precaution of intelligent tinkering.
Aldo Leopold (1993)

Introduction

Important wildlife habitat is being lost at a rapid pace because it is worth far more financially as fragmented subdivided parcels for development. Even though this land produces many positive benefits, such as wildlife habitat, open space, water filtration and carbon sequestration, many of these benefits are either undervalued or not valued at all by the market. This market failure often results from not being able to exclude users from accessing the benefits. As a result, these users or free-riders can consume the resource without payment. There has been an increasing effort by the natural resource organizations and agencies to address this market failure by developing ecosystem service markets in order to conserve wildlife habitat. In the past decade, these markets have expanded dramatically. Private venture capital has invested hundreds of millions of dollars speculating in new ecosystem services markets, such as carbon, wetlands, biodiversity and water emerging markets. The public sector has also taken critical steps with the U.S. Congress, creating a new agency, USDA's Office of Environmental Markets, specifically focusing on this area. Proponents of the concept of developing ecosystem service markets assert that if individuals and institutions can better understand and recognize the value of conservation and environmental benefits, society and private markets will value the resources more and increase the level of investment into the conservation and protection of these important conservation and agricultural lands.

Biodiversity Loss

The problem is really a four-part problem. The first part of the problem is the loss of biodiversity. The Millennium Ecosystem Assessment (2005) shows that human actions often lead to irreversible losses in terms of diversity of life on Earth, and these losses have been more rapid in the past 50 years than ever before in human history. Over the past few hundred years, humans have increased the species extinction rate by as much as 1,000 times background rates typical over the planet's history (medium certainty). Extinction is a natural part of Earth's history. Most estimates of the total number of species today lie between 5 million and 30 million, although the overall total could be higher than 30 million if poorly known groups such as deep-sea organisms, fungi, and microorganisms including parasites have more species than currently estimated. Species present today represent only 2 to 4 percent of all species that have ever lived. The fossil record appears to be punctuated by five major mass extinctions, the most recent of which occurred 65 million years ago.

The Millennium Ecosystem Assessment (2005) continues estimating that 12 percent of bird species, 23 percent of mammals, 25 percent of conifers and 32 percent of amphibians currently are threatened with extinction worldwide (Figure 1). Loss of species leads to loss of ecosystem function, affecting ecosystems at all levels from decomposers to primary producers to secondary consumers. Loss of ecosystem function ultimately will lead to greater ecological, financial and social problems than we currently face.

Market Failure

In addition to loss of species and ecosystem health decline, there is an economic market failure associated with ecosystems. Economists classify goods into four types: private goods, common goods, club goods and public goods based on the classification of whether or not a good is rival or excludable (Figure 2). Rival goods are goods whose consumption by one consumer prevents simultaneous consumption by other consumers. A good is said to be excludable when it is possible to prevent people who have not paid for it from having access to it. An example of a market good is a bolt action rifle. Market goods are both rival and excludable. The market does an exceptional job of providing the socially desirable number of goods and services at a price that individuals are willing to pay for the good. However, the market does not do such a good job of producing socially optimal solutions for public, club or common goods. For example, a common good is a good that is rival but not excludable. An example of a common good is a wetland habitat. Since there is no practical way to exclude people from enjoying the benefits a wetland provides–wildlife habitat, clean water–essentially anyone

who happens to be near it enjoys it. How do you get people to pay for it when they can enjoy it for free. Since it is difficult to prevent people from gaining this benefit, non-excludibility leads to free riders which eventually leads to nonprovisioning of the good.

Figure 1. Extinctions per thousand species per millennium (Millennium Ecosystem Assessment 2005).

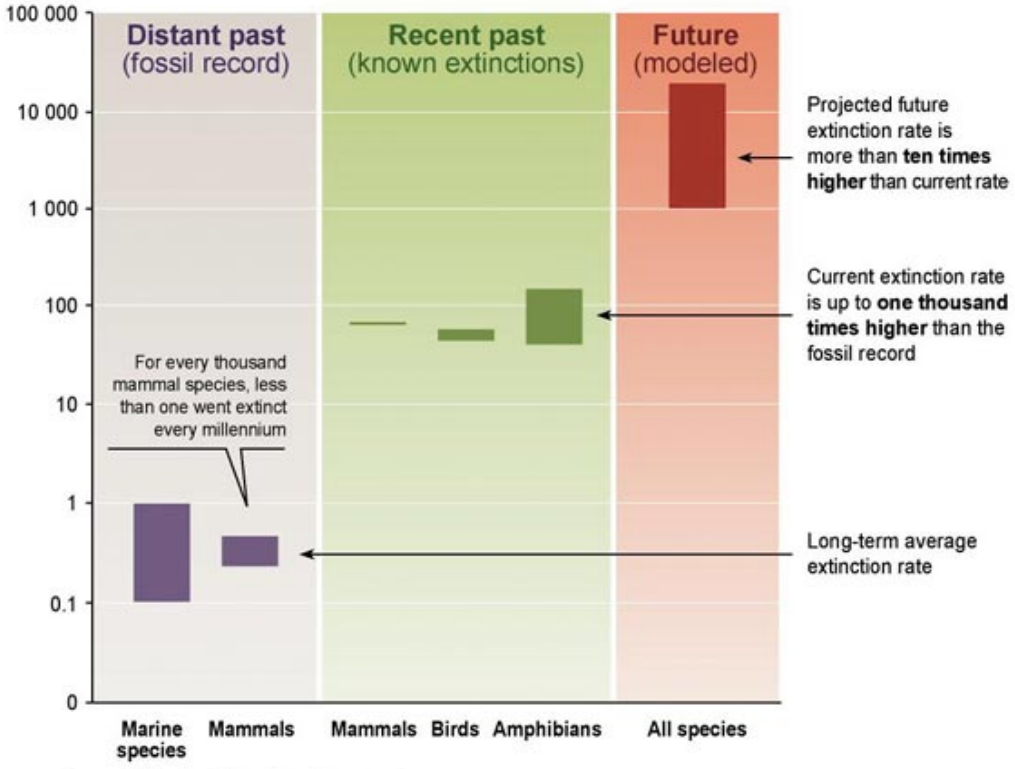
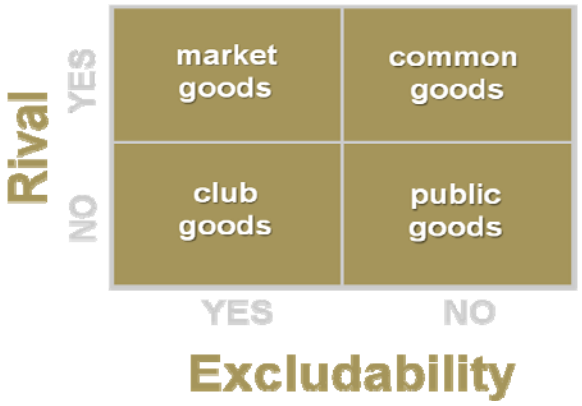


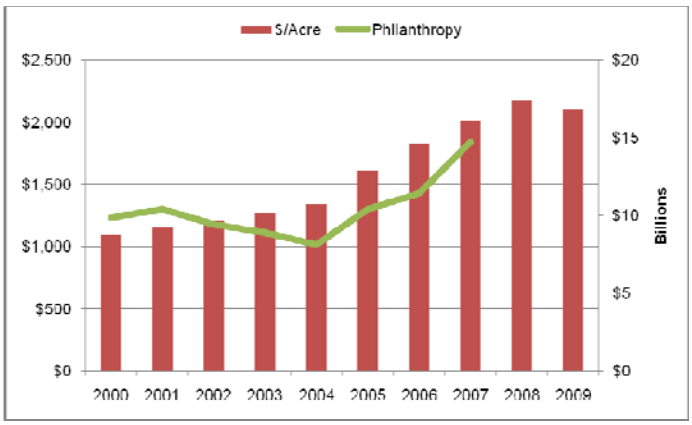
Figure 2. Economists generally classify goods into four types and distinguish them by whether they are rival or excludable.



Cost of Conservation and Declining Conservation Funding

In addition to biodiversity and ecosystem function decline, available conservation funding is declining while the cost of conservation is increasing. "The nonprofit world is about to face the toughest year in its history. By every measure, 2010 could be far more painful for charities and the people they serve than any other they have known. Already many charities have been weakened by one of the longest recessions America has witnessed." The Chronicle of Philanthropy's annual ranking of the 400 charities that raise the most money found that, by year's end, the nation's top organizations expect a median decline of 9 percent in donations, meaning half will see giving drop even more starkly. In addition to declining funding, whether that is traditional philanthropy or state fish and wildlife budget, there is an increase in the cost of conservation. The cost per acre of land has generally been increasing over the last decade, as supported by increasing USDA farmland prices per acre in Figure 3.

Figure 3. USDA farm average price per acre for 2000 to 2009 with philanthropic capital for environment and animals as estimated from The Foundation Center.



Emerging Ecosystem Service Markets

In summary, the four-part problem can be summarized as declining biodiversity and ecosystem function, market failure from our inability to exclude people from benefits, an increase in the cost of conservation, and declining resources. This four-part problem is the reason ecosystem service markets are so appealing. Despite the slow process, both the public and private sectors are still pursuing ecosystem service markets because they offer the hope of developing ways to increase the current level of resources devoted to conservation. Simultaneously, new ecosystem service markets are on the rise. In a recent article in *Harper's Magazine* by Mark Sharpiro (2010), he wrote, "Carbon trading is now the fastest-growing commodities market on earth. Since 2005, when major greenhouse-gas polluters among the Kyoto signatories were issued caps on their emissions and permitted to buy credits to meet those caps, there have been more than $300 billion worth of carbon transactions." Additionally, he continues stating that major financial institutions now host carbon trading desks and that experts predict a $2 to $3 trillion carbon market if/when the U.S. passes a national cap and trade policy. Carbon is not the only emerging ecosystem service market. A recent report by Ecosystem Marketplace (2010) covering wetland and conservation banking estimated a conservative global annual market size of $1.9 to $2.9 billion with a conservation impact of this market including at least 100,000 hectares of land under some sort of conservation management or permanent legal protection.

Case Study–Market Hunting

An argument could be made that the historical roots of ecosystem service markets originate from wildlife conservationists such as Roosevelt and Grinnell. One of the earliest examples in the U.S. of private and public partners working together to solve the market failure of free riders associated with the inability to exclude individuals from accessing the resource by restructuring property rights and developing incentives to wildlife in order to solve a conservation problem related to a market failure is market hunting. By the turn of the 20th century, commercial hunting and loss of habitat due to agriculture led to a decline in duck and goose populations in North America, along with many other species of wildlife. The Lacey Act of 1900, which outlawed transport of poached game across state lines, and the Migratory Bird Treaty Act of 1918, which prohibited the possession of migratory birds without permission (such as a hunting license), were the first steps to create a sort of cap and trade for wildlife populations. In 1934, at the urging of editorial cartoonist and conservationist J.N. "Ding" Darling, the U.S. government passed the Migratory Bird Hunting Stamp Act, better known as the Federal Duck Stamp Act. This program required hunters to purchase a special stamp, in additional to a regular hunting license, to hunt migratory waterfowl. Revenues from the program provided the majority of funding for conservation for many decades and funded the purchase of 4.5 million acres (18,000 km^2) of National Wildlife Refuge land for waterfowl habitat since the program's inception. The Duck Stamp Act has been described as one of the most successful conservation programs ever devised. Duck stamps have also become collectible items in their own right.

Essentially, early wildlife conservationists solved the market failure excludability problem and restructured properties rights by essentially developing a cap law not too unlike the proposed cap for carbon and then monetized wildlife by selling permit and habitat stamps. By doing so, they conserved wildlife populations and developed important funding streams for fish and wildlife agencies.

Case Study–Rocky Mountain Carbon

How would Theodore Roosevelt solve our conservation problems 125 years later? Can we turn a problem into an opportunity whether we are dealing with pollution of waterways or subdivision of grasslands? If we were going to apply the same sort of strategy toward the protection of grasslands, how would we solve that problem? Since I am passionate about developing a Rocky Mountain grassland carbon market, I will outline the steps I would take to develop a grassland carbon market.

Having worked in carbon for the past few years, I'll be the first to say that it's confusing. We generally have regulatory markets and voluntary markets–and we have those markets operating at different scales. At the international scale, you may have heard of the regulatory market Kyoto/Copenhagen and the Clean Development Mechanism which is popular in Europe. In the U.S., at a national scale, we have proposals for cap/trade. There are several regional regulatory initiatives such as the Regional Greenhouse Gas Initiative (RGGI) in the Northeast, and at the state level we have California leading the way with the California Climate Action Registry (CCAR). Additionally, there are voluntary markets that have protocols such as the voluntary carbon standard (VCS) that span habitat types.

What does all of this mean to me if I am a landowner. If I am landowner in California and own 50,000 acres of trees and am willing to permanently sequester carbon, I can sell these credits to the State of California or CCAR or a voluntary market. However, if I am a similar landowner in Colorado with 50,000 acres of grassland, I am out of luck. Colorado does not have a regulatory market and last I checked there is no voluntary market created for avoided grassland conversion. So, what are our options? Develop a regulatory or voluntary market? I think our best option is to develop a voluntary market for grassland carbon. At a broad level, I see this as a two- part public/private partnership. The first part is to develop the market infrastructure estimated at $100 to $250 thousand and two to three years en route to market ,and the second part, which needs to be developed simultaneously is to determine and sector up demand or private sector investment.

Part one is focused on developing market infrastructure. In the case of carbon, that would be developing methodology. A methodology would need to be developed demonstrating how the baseline carbon sequestration level will be calculated (i.e., what would be sequestered under the "business as usual" scenario) and the project carbon sequestration level (i.e., what would be sequestered if you permanently protected the land). We would next need to determine whether you will have this methodology approved by an existing protocol (such as the Voluntary Carbon Standard) (methodology approval – six to nine months). The next step would include defining the project area and making some initial assessments based on your methodology to create a feasibility study of whether the project makes economic sense (one month). If the feasibility results warrant, begin developing the project documents, hire outside third-party validators, launch the project under the specific protocol that has approved your methodology, etc. (six to nine months if everything goes well).

Part two is focused on demand and would include a partnership with the private sector for a pre-sale agreement to purchase a set number of tons of carbon at a certain price contingent on approved methodology by a certain time and a minimum price of carbon.

In summary, by taking the chance to develop a new voluntary market for carbon and developing a public/private sector partnership, we would potentially attract millions of private dollars to grassland conservation, and better position the region for a regulatory market.[1]

Potential Benefits of Partnering with the Private Sector

The primary benefits of partnering with the private sector are resources, resources and resources. In addition to resources, the private sector also offers speed and flexibility. Private capital allows the public capital to stretch conservation across much wider boundaries. It's the doughnut analogy. If public money buys fee in the doughnut hole but uses easements, etc., to ensure the buffer around the doughnut hole remains in compatible habitat and well-managed, the

[1] While this process is simplified for the purpose of this paper, grassland carbon has some unique challenges that would have to be addressed along the way. Essentially, we need to understand what types of activities will increase carbon storage in soil and the associated uncertainty about the impacts of different moisture regimes, soil type, etc. on these rates. Even though it should be a little bit easier to figure out how much carbon is stored in protected grassland, you still need to understand the dynamics of what happens if the project does not occur – will it be grazed? planted? If so, how much carbon do those activities sequester? You need to understand this to determine the additional carbon resulting from the project. My personal opinion is that before we are able to create any system that provides a method for carbon quantification to develop a project, we must understand these dynamics.

Another option to consider that may avoid all of this uncertainty, long development times and high development costs would be just to launch the project. An organization could potentially find a property that is eligible for conservation, find someone willing to invest in protecting the land with an understanding that whatever carbon is sequestered in the project will be theirs, and then just start monitoring the effects of the conservation through a regular field survey of the site and comparing it with nearby unprotected areas. You could even find some third party verifiers to validate this if you wanted some additional transparency in the process. This would mean that your carbon credits would not meet the rigor of an official protocol, but that may not matter to buyers or other partners.

public resources accomplish much more conservation for the same dollars. In addition to increased resources that leverage public resources, private capital can act much faster in many situations.

Steps the Public Sector Can Take to Attract Additional Private Sector Capital

The goal of the private sector is all about providing a risk-adjusted competitive financial return for their investors. Since time is money, anything you as agencies can do to help improve the financial return by reducing risk and shortening the time of the project will only accelerate the development of these new markets and attract additional capital. The public sector can take several steps to attract additional private sector capital such as providing market infrastructure, such as a regulatory market for carbon, which reduces uncertainty and ultimately risk. The public sector can provide science expertise that is often needed in order to make sound investments. Additionally, anything the public sector can do to increase speed, transparency and consistency will also make strides toward attracting private sector capital. Finally, the public sector needs to encourage an entrepreneurial spirit and commitment toward working on experimental and pilot projects in order to build trust and provide the foundation for these markets to take root.

Additional Projects and Resources

There are several exciting resources and partnerships forming around ecosystem services. Resources such as Ecosystem Marketplace or the Defenders of Wildlife's Conservation Registry are steps toward providing the critical information, infrastructure and resources essential for the development of these projects. Additionally, projects such as the Willamette Partnership and Bay Bank are examples of sophisticated efforts to push this field forward. For example, The Willamette Partnership is a non-profit organization with the mission of expanding the pace, scope and effectiveness of restoration in northwestern Oregon's Willamette Basin by developing an ecosystem service program that generates four ecosystem credit types: salmonid habitat, upland prairie habitat, wetland, and water quality/temperature, and rewards landowners for undertaking the best restoration actions in the best places.

Conclusion

Conservationists have been working to solve the market failure associated with biodiversity decline in the U.S. by restructuring property rights, aligning incentives and monetizing ecosystem services since the days of Theodore Roosevelt. What would Theodore Roosevelt do 125 years later? There is no question he would be leading the charge to develop new markets, launching pilot projects all over the country. Why? Because what other choice is left to us with declining biodiversity and declining budgets except to work to solve the market failure and restructure property rights and provide incentives for wildlife, water and open space.

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Forest Eco-services: Creating Solutions to Conservation and Climate Through Sustainable Stewardship

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Commodity Production and Ecosystem Functions

Traditionally, timber production and development opportunities have presented the most lucrative usage options for private forestlands. Clear markets for both timber products and development facilitate management decisions that prioritize commodities over other goods and services that are not incorporated as easily into the market. However, the worth of forests extends far beyond the mere production value of easily commodified goods. Forests provide a suite of ecosystem service functions that are not readily included within a conventional market framework, such as the provision of clean air, clean water, wildlife habitat and climate regulation (Millennium Ecosystem Assessment 2005). Despite the importance of forests for the provision of these other non-market ecosystem goods and services, economic pressures result in a prioritization of activities that produce commodities, such as timber harvest or development, and frequently conflict with the provision of other, non-commodity ecosystem service functions. Maximizing timber returns on private lands often means harvests of increasing intensity and frequency, which can leave forest stocks depleted and ecosystems degraded. Rather than retaining their forests for timber production, landowners instead may choose to pursue the value of their lands for conversion and development. Capitalizing on the development opportunities afforded by forestlands generally requires some degree of forest conversion to other land-use types, which can vastly reduce, if not altogether eliminate, forest cover and the ecosystem functions associated with these lands. Both outcomes have serious implications for the forest ecosystems and the non-commodity services they provide.

The Role of Forests in Climate Change

Forests are unique in the dual role they play in context to climate change. Standing, ecologically robust forests remove carbon from the atmosphere as they grow, diminishing the concentration of greenhouse gases in the atmosphere. If undisturbed, this carbon can be stored in forest ecosystems for centuries or even millennia. However, when forests are degraded or depleted, they become contributors to global climate change instead of working to forestall it. When forests are lost, the carbon stored in these ecosystems is not only emitted, but the future sequestration potential of forests, or their ability to remove carbon dioxide from the atmosphere, also is foregone. Despite their importance in mitigating climate change, the historic loss of forests globally has played a large part in elevating the atmospheric carbon concentrations that drive climate change. Approximately 40 percent of all anthropogenic carbon that has been emitted into the atmosphere since industrialization is attributable to the conversion of global forests (Prentice et al. 2007). Despite the tremendous role our forests here in the United States play in mitigating climate change, offsetting nearly 20 percent of all domestic emissions annually, conversion continues to erode our forest assets and is responsible for the loss of more than 1.5 million acres of forest annually (Environmental Protection Agency 2008,U.S. Department of Agriculture 2007).

Habitat Loss and Forest Conversion

Despite the ramifications of forest loss and degradation for ecosystem service functions, few financial incentives historically have been available to reward landowners for managing their lands to produce goods or services without clear market value. Instead, landowners preferentially have managed their forestlands to maximize revenue streams, either through timber production or conversion and development. Because wildlife habitat generally requires great forest extent and contiguity, it is one of the first non-commodity ecosystem service functions subverted when management focuses solely on the maximization of financial returns. The habitat fragmentation and loss resulting from a narrow focus on fiscal returns has had serious effects on wildlife populations in the United States, and is the most prevalent cause of endangerment for species listed under the Endangered Species Act (ESA) (Easter-Pilcher 1996, Foin et al. 1998, Flather et al. 1998).

Unlike other, discrete threats to wildlife, such as off-highway vehicles (OHVs) or point-source pollution, the systemic nature of habitat loss complicates regulatory efforts to address it. These regulatory challenges are clearly

reflected in the status of imperiled species listed under the ESA. Of those species currently listed and continuing to decline, habitat loss from development is a foremost cause of this continued population decline (Abbitt and Scott 2001). Despite recognizing the importance of addressing ecosystem conservation under the ESA, its implementation has encountered difficulty in actually realizing this due to challenges in approaching ecosystem-level conservation (Doremus 1991). Where private properties are concerned, the effectiveness of regulatory approaches in reducing the loss of wildlife habitat from conversion are necessarily tempered by private property rights and landscapes fragmented by multiple ownerships or jurisdictions. As a result, the actual implementation of the ESA has often tended more toward a single-species approach, despite its shortcomings in addressing the overall dynamics of ecological systems as a whole (Flather et al. 2005).

Promoting Conservation through Innovation

Recognizing the reality of economic pressures facing forest landowners and the shortcomings of regulatory solutions, several innovative approaches have been pioneered using market mechanisms to address these challenges. These strategies recognize that the undervaluation of non-commodity ecosystem functions are a central driver in forest management trends that lead to forest degradation and depletion. Accordingly, these approaches seek means by which to provide landowners with compensation for management that maintains and increases these ecosystem functions. While each individual incentive program alone may not be sufficient to overcome the economic pressures driving forest degradation and conversion, in the aggregate, these additional revenue streams have demonstrated enough additional income on the margin to alter the course of traditional forest management decisions.

The Van Eck Forest

The Pacific Forest Trust first pioneered these innovative approaches to conservation on the Van Eck Forest in northern California. The 2,200-acre Van Eck Forest comprises four different parcels, and is surrounded by urbanization and intensively managed industrial forests (Figure 1). Coast redwoods (*Sequoia sempervirens*) are the dominant species on Van Eck, with a variety of other conifers also present to a lesser extent, primarily Douglas-fir (*Pseudotsuga menziesii*) and Sitka spruce (*Picea sitchensis*). The property provides prime habitat for a number of important terrestrial and aquatic species, many of which are threatened or endangered, including the northern spotted owl (*Strix occidentalis caurina*), northern red-legged frog (*Rana aurora aurora*), southern torrent salamander (*Rhyacotriton variegates*) and osprey (*Pandion haliaetus*).

Figure 1. Van Eck Forest: Islands in a fragmented landscape (Source: The Pacific Forest Trust 2008).

In 1996, Fred Van Eck, the property owner, contacted the Pacific Forest Trust about options for conserving his forest property. Mr. van Eck was the head of a financial firm that focused on long-term investments and believed in the synergy of sustainable economic and environmental returns. Concerned that traditional industrial forestry practices and

development pressures in the region were resulting in the degradation and depletion of local forests, Mr. van Eck wanted to ensure that his property did not fall prey to a similar fate. At the time, his lands held, on average, more than 20,000 board feet of merchantable timber per acre. While this was considerably less than what forests of the area had historically held, the stocking levels on Van Eck Forest were in stark contrast to the forestlands bordering his property, which held fewer than 7,000 board feet per acre, on average. As part of his estate planning, Mr. van Eck was interested in finding revenue streams that would reward management approaches such as his own that treated forest properties as long-term investments and allowed them to remain as forests. The Pacific Forest Trust worked with Mr. van Eck to develop these ideas into an innovative, new conservation model.

Implementing Innovation: Conservation in Practice

The Van Eck Forest represents a model of land conservation that complements, rather than conflicts with, the working character of the landscape. This model is based upon the provision of financial benefits for sustainable management practices, and is underpinned by four fundamental elements: (1) working forest conservation easements (wfces); (2) increasing timber inventory through sustainable management; (3) forest carbon emission reduction payments; and (4) regulatory certainty and simplification.

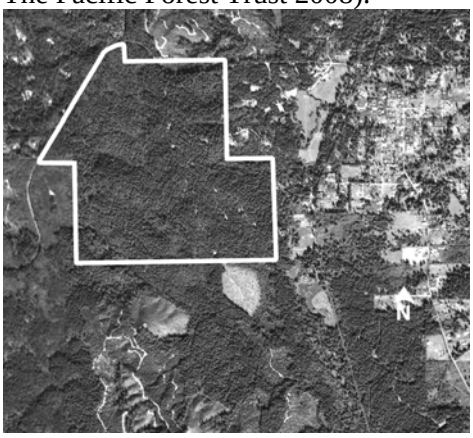
Working Forest Conservation Easements

In response to Mr. van Eck's wishes, a working forest conservation easement (WFCE) was granted on the Van Eck Forest in May of 2001. While traditional conservation easements focused on retaining land as "forever wild" or as "open space," the WFCE concept was revolutionary in that it emphasized the synthesis of sustainable management and environmental protection. The WFCE provided forest landowners with an option to retain their forests as an economically and ecologically sustainable "working landscape." This non-traditional use of a traditional conservation tool has proven successful in providing a supplemental source of income or tax benefits for the owners of working forestlands, provided these lands are sustainably managed and remain under forest cover in perpetuity. WFCEs hold great future promise in helping forest landowners resist pressures to over-harvest or convert their holdings, and are already being successfully replicated across the country by small forest landowners and large real estate investment trusts (REITs) alike.

Increasing Timber Inventory through Sustainable Management

Under the terms of the WFCE, the lands of the Van Eck Forest were to be dedicated solely to use as a sustainably managed, working forest. Part of this commitment to sustainability was a management approach that allowed stocking levels on the Van Eck Forest to continue to increase. While the Van Eck Forest held far more timber per acre than the surrounding properties, Mr. van Eck knew that the current stocking levels were still only a fraction of what his forest could hold. To ensure his stocks would continue to grow, the WFCE specified that only 50 percent of growth could be harvested annually until stocking reached 70,000 board feet per acre, at which point harvests would remove not more than 15 percent of the net merchantable forest inventory per decade.

Figure 2. Growth pattern of forests, from initiation to maturity, and the culmination of mean annual increment (Source: The Pacific Forest Trust 2008).



As a result of this practice of removing less than was grown each year, the annual harvestable volume of timber on the Van Eck Forest continues to increase, and will do so until the culmination of mean annual increment (Figure 2). Ultimately, the goal is to allow forest stocking to increase to a minimum of 100,000 board feet per acre. While this still does not fully approximate what the natural forest would have held, it is dramatically greater than the stocking required by

law or typically found on intensively managed forests. By harvesting at a sustainable level, both stocking and harvest volumes are being allowed to increase, and both will more than double in 50 years (Table 1). This not only provides environmental sustainability through the ecosystem functions attendant to increased forest stocking, such as wildlife habitat and carbon stores, but also provides an economically sustainable, increasing revenue stream over the long term.

Table 1. Van Eck California growth and yield summary, 2005 to 2055 (Source: The Pacific Forest Trust 2008).

Reporting year	5-year period	Total volume	Volume per acre	Annual growth per acre	Total annual growth	Total annual harvest	Average harvest per acre
2005	0	62, 493, 760	29,702				
2010	1	73,767,596	35,061	1,561	3,284,930	1,030,163	8,818
2015	2	83,629,130	39,748	1,501	3,159,015	1,186,708	9,031
2020	3	93,470,868	44,425	1,508	3,171,989	1,203,642	10,269
2025	4	101,216,586	48,107	1,462	3,075,536	1,526,392	11,797
2030	5	108,091,655	51,374	1,381	2,906,299	1,531,285	11,087
2035	6	114,087,354	54,224	1,440	3,030,653	1,831,513	13,650
2040	7	118,563,586	56,352	1,358	2,857,991	1,962,745	15,169
2045	8	123,466,413	58,682	1,412	2,970,897	1,990,331	14,411
2050	9	128,227,551	60,945	1,291	2,716,926	1,764,698	12,959
2055	10	131,317,724	62,413	1,302	2,738,923	2,120,888	16,391

Forest Carbon Emission Reduction Payments

In addition to the WFCE and sustainable timber harvests, a forest carbon emission reduction project established on the Van Eck Forest now provides another source of income. This carbon project created an additional revenue stream for the climate benefits the Van Eck Forest provides and helped offset the initial reductions in timber harvest removals adopted under the sustainable management regime. This carbon project centers on the recent interest in climate change mitigation efforts and has presented a means by which the climate benefits of the forest can be quantified, valuated and exchanged in nascent carbon markets. Carbon projects allow landowners to market the climate value of their lands like any other commodity and provide a way in which landowners can be compensated for managing their lands to produce these benefits. The forest emission reduction credits generated on the Van Eck Forest are already being sold in voluntary markets, where consumers voluntarily elect to offset their carbon emissions through the purchase of forest carbon credits. These credits will also be available in eventual compliance markets, where emitters are required to either reduce their emissions or offset them via the purchase of emission reduction credits.

Regulatory Certainty and Simplification

Sustainable management of forestlands through WFCEs offers direct benefits to forest landowners through new revenue streams for ecosystem service functions while allowing for traditional revenue streams, such as timber production, to be maintained at sustainable levels. While landowners derive direct benefits from these new and traditional revenue streams, the indirect benefits associated with this conservation model also can be substantial. In the case of the Van Eck Forest, which is home to several threatened and endangered species, the terms of the WFCE were drafted in consultation with the U.S. Fish and Wildlife Service (USFWS). During this process, the Pacific Forest Trust worked with the USFWS to craft the easement so that ESA concerns relating to northern spotted owls occurring on the property would be addressed. The subsequent Safe Harbor Agreement (SHA) arising out of this process is valid for 99 years from the date of its enactment and will provide the managers of the Van Eck Forest with regulatory certainty in context to the ESA for its 99-year duration. By addressing these ESA concerns *ex ante* during the drafting of the WFCE, the managers of the Van Eck removed substantial regulatory uncertainty from their future timber and forest management operations. While ESA considerations were the most pressing in the case of the Van Eck Forest, the potential for indirect regulatory benefits is not necessarily limited to this piece of regulation alone. The incorporation of regulatory considerations into the creation of easements could be useful as a general model to simplify the regulatory process and minimize future uncertainty for landowners in context to a variety of different regulatory scenarios.

Conclusion

Working forests and conservation do not have to be in conflict. The model pioneered by the Van Eck Forest suggests that both economic and environmental returns may be compatible if forests are managed sustainably and with an eye to the future. Increasing interest in other forms of ecosystem markets is broadening the opportunity to reflect the monetary value of ecosystem services in the marketplace. These opportunities can provide land managers with new revenue streams for ecosystem services and begin to counter pressures to overharvest or convert their forests to other uses. Conservation strategies that focus on maintaining landscapes as forests, especially those working forestlands that are threatened by degradation and depletion, demonstrate great promise in addressing the problem of habitat loss and its consequences for wildlife at a landscape level. By recasting forests as long-term investments rather than simply instruments of short-term gain, forest managers can enjoy both the economic and environmental values of their forest assets, values which do not have to exist in mutual exclusion.

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Special Session Two.
Active or Passive Management of Public Lands: Implications for Fish and Wildlife Conservation and Management

Wilderness in the 21st Century: Problem or Opportunity?

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The Wilderness Act of 1964 (Act) is arguably one of the most far reaching and ambitious of our nation's environmental policies. Passage of the Act was the culmination of three decades of planning, lobbying and publicizing the virtues of wilderness, largely led by The Wilderness Society. Leaders of this movement included Aldo Leopold, Robert Marshall and Howard Zahniser. The Act famously sets forth a seemingly straightforward definition of wilderness:

> "A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and community of life are untrammeled by man, where man himself is a visitor who does not remain." (P.L. 88-577, 16 U.S.C. 1131-1136, 78 Stat. 890)

It was easy to think of wilderness in this way, not least because there remained, primarily in the west at the time, large tracts of federally owned land that had not been severely impacted by human activities. Moreover, the phrase, "visitor who does not remain," seemed to neatly preclude any lasting disturbance to those areas designated as wilderness.

The value of wilderness seemed intuitively obvious in the mid-1960s: we had been rapidly shifting from a nation of farms and small cities to a nation dominated by expanding metropolitan areas. In 1920, approximately 50 percent of the population was classified as "rural" and another 40 percent lived in towns and small cities; only 10 percent of the population lived in densely settled cities (U.S. Census Bureau 2008). Small farms were either being gobbled up by ever larger agribusinesses or by suburban developers. The interstate highway system gave Americans unprecedented access to our national parks and to remote areas of national forests and rangelands. It was clear that the time had come to set limits on the use of our remaining unprotected wild lands.

The public appeared willing to accept the idea of declaring large swaths of unoccupied land wilderness and protecting them from intensive exploitation. This was due, in part at least, to a recognition that policies put in place in the early decades of the 20th century, covered by the rubric "conservation," had been successful. Government conservation agencies enjoyed public support in no small measure because they had been producing tangible results. Many imperiled fauna, both game and nongame species, had been brought back from the brink by laws sharply curtailing the taking for commercial purposes. Unregulated logging was, at least in principle, being regulated with an eye to sustainability. Farm productivity was rising rapidly, presenting us with the novel problem of surplus. All was not rosy, however. With the publication of Silent Spring (Carson 1962), a new source of alarm was sounded that, combined with growing concerns over nuclear armament and its implications, cast doubt over the integrity of science and scientists (Organ et al. 1998).

In this context, entrusting large amounts of land to the federal government to handle with a "hands-off" approach seemed a wise thing. With the dramatic effects of market hunting still fresh and the successes of the government in restoring wildlife all too evident, confidence in government's capacity to protect the public interest was high, probably as high as it has been before or since. (Indeed, public opinion polls in recent years have repeatedly shown the public to be suspicious of, if not overtly hostile to, the government's ability to protect the public interest.) Saving wilderness seemed right, just as, less than 10 years later, protecting endangered species seemed the right thing to do. Nearly 50 years after the passage of The Wilderness Act and nearly 40 years after passage of the Endangered Species Act, what seemed straightforward seems much less so.

[1] The views expressed in this paper are the author's and do not necessarily represent those of the U.S. Fish and Wildlife Service.

"In Wildness is the Preservation of the World" (Thoreau 1893: 9)

Wilderness became the rallying cry for a generation who knew that the commercial exploitation of natural resources, including aesthetic resources, would invariably lead to an exhausted and impoverished environment. Led by The Wilderness Society, the Sierra Club, as well as a steadily growing list of environmental groups and organizations, a very compelling case was made for the preservation of remote and ruggedly spectacular landscapes. Ansel Adams's photographs, marketed by the Sierra Club in posters and their near-iconic calendars, came to epitomize what wilderness represented: the embodiment of the sublime. Here was nature as it was meant to be—from lush, dense stands of Douglas-fir (*Psuedotsuga menziesii*) to the austerity of the mesas of the southwest, from impressive mountain peaks to the depths of Death Valley—at once alluring and forbidding; not places for the faint of heart.

Setting aside wilderness also seemed inexpensive. Land acquisition costs were nil, since the federal government owned most of the sites and, unlike the National Parks, there would be little need for upkeep. After all, the then prevailing view, about which we will have more to say shortly, was that wilderness was, by definition, self-regulating. The forests were ancient, the canyons and gorges the product of wind and water working away for millennia. Wilderness inspires not simply by its grandeur but also because it seems timeless. Why tinker (i.e., spend)? Cost society would bear would be the lost opportunity of profit-making from logging, mining and drilling. But visitors with the loftiest of motives can have an unwelcome effect on wilderness. Aldo Leopold saw the dilemma clearly: "But all conservation of wildness is self-defeating, for to cherish we must see and fondle, and when enough of us have seen and fondled, there is no wildness left to cherish" (Leopold 1937).

The stage was thus set for managing wilderness—or, more precisely, for managing access to areas designated as wilderness. The need to limit public access immediately gives rise to the question "what is wilderness for if not our enjoyment?" There are several answers to this question, starting with Leopold's advocacy for wilderness preservation. For nearly three decades, he formulated a hierarchy of wilderness values that, in ascending order, were articulated as: esthetic, biological, recreational, cultural and scientific (Meine 1988). Leopold argued that wilderness areas would serve as refugia for wildlife species hard pressed by the loss of habitat. He was particularly concerned with species requiring large ranges. His notion of recreational value was restricted to hunting, fishing and backpacking. It is doubtful he or anyone else could have predicted the surge in outdoor recreation, especially wilderness recreation, that began shortly after his death.

Leopold, when he wrote "Shall we now exterminate this thing we call American?" (Leopold 1925) was harkening back to ideals regarding the impact of wilderness and the frontier on shaping what it is to be an American; ideals articulated in the late 19th century by Frederick Jackson Turner (1935), Theodore Roosevelt and George Bird Grinnell (Cutright 1985, Miller 1992, Brands 1997). This reflected the romantic notion of primitivism, where the best antidote to the ills of an overly refined and civilized modern world was a return to a simpler, more primitive life (Cronon 1995). In this context, wilderness became a source for national renewal. As Cronon (1995) postulates, protecting wilderness protected the nation's myth of origin.

Finally, Leopold argued that wilderness provides us with a standard, a base line, against which we can measure the effects of our manipulations of the land. Leopold saw wilderness as the epitome of "land health"; by studying the processes by which a wilderness area maintains itself over time--how it recovers from storms and lightening-started fires, how it repels pests, how it endures drought or heavy precipitation—we may become better managers of the lands we crop, whether for food or wood products.

Leopold's case for wilderness protection has informed advocacy for wilderness for two generations. While passage of the Act was certainly a watershed moment for conservation, it by no means quelled debate over wilderness. Wilderness remains contested for several very different reasons and it is to these that we now turn.

What is "Wild"?

Conventional critics of wilderness hark back to the nation's Protestant roots: wilderness was wasteful and waste, like idleness, was sinful. Wilderness harbored savage heathens and all sorts of evil wildlife. This now sounds awfully quaint, but we should not forget that none other than Thoreau favorably regarded his haunts in Concord because they no longer contained the sorts of savage beasts that still roamed Africa and India (Thoreau 1893). And as many have pointed out, Thoreau was not enthralled by his encounter with the ruggedness of Mount Katahdin (Botkin 2000). And when Muir invited Emerson to spend several days camping in the redwoods, Emerson made it clear that he preferred a hotel (Turner 1985). To be fair, Emerson was quite elderly, but age was probably reinforced by proclivity.

Nowadays, erasing sin is less the issue than chasing resources: oil, natural gas and timber, primarily, but also precious metals. And then there is the more or less constant pressure of recreational interests, particularly those who don't accept the sorts of recreation that Leopold saw as appropriate to wilderness, such as ATV and snowmobile enthusiasts.

These are all familiar threats to extant wilderness areas, as well as the basis of opposition to proposals to expand wilderness protection. We will not dwell on these threats, though we don't for a minute underestimate the constant need to defend what remains of our wilderness areas.

We are interested in a very different sort of challenge, one that bears more on managing wilderness than people. As we noted at the outset, wilderness was promoted as the product of inexorable natural forces that, through natural selection, had achieved just the right mix of organisms, each well adapted to the others in a complex web of interdependencies. This complexity, it was believed, yielded stability, what Clements called "climax" (Clements 1916). To the extent to which there was a history of the system, it was a cyclical history. Climax gave way to externally generated perturbations—storms, fire, etc.—which, when the dust settled, gave way to an orderly, stage-by-stage, recovery that, in time, reproduced the original climax condition.

In the 50 years since the Act's passage, this view of how things work has been sharply challenged (Kricher 2009). Rather than an orderly, prefigured, march to climax, systems are now thought to be much more unruly, with any particular outcome after a disturbance highly contingent. Instead of species being knitted closely together into a single "super organism," ecologists are much more inclined these days to see erratic interactions that produce constant flux. Whether we are talking about forest succession or predator/prey interactions, the old models of equilibrium, dynamic or otherwise, are in disarray (Botkin 2000, Kricher 2009, Lewontin 2000).

If the critics of Clementsian theory are right, and mounting evidence keeps pointing in that direction, it becomes hard to say what managing a wilderness area means. Are pest invasions a normal feature of forest dynamics or do invasions set the stage for a forest that differs in important respects from the original forest? Does it matter, so long as we remain visitors and spectators, rather than active managers? From a scientific point of view, contingency or stochasticity need not be disconcerting; indeed, if everything was perfectly predictable, we'd all be out of jobs. The value of wilderness as a laboratory in fact is heightened precisely because the predictive models we once believed in no longer suffice. Whether studying the dynamics of wilderness will provide us with knowledge we can apply to disturbed sites, as Leopold and many others had suggested, is an open question.

Research opportunities should become both more abundant and more urgent in the coming decades. Visitors, recreationists and scientists can be persuaded to respect the wilderness, but the effects of human activity taking place far from the boundaries of wilderness areas are now well known. Climate change and invasive species are highly likely to change the face of virtually all of our protected areas (Halpin 1997, Karl et al. 2009). To take but one example, the mountain pine bark beetle (*Dendroctonus ponderosae*) infestation that is currently raising havoc in the West might well be a natural event. The lodgepole pine (*Pinus contorta*) forest and the beetle have been around for a very long time. But with changing weather patterns, including the likelihood of hotter and drier conditions, can we be confident that the venerable cycle will repeat itself? Does change induced by anthropogenic sources threaten the very idea of "wilderness"?

Many natural cycles (migration patterns, etc.) have already begun to be affected by climate change, and more change is in store. Will wilderness areas be affected in ways that diminish their aura, thus threatening the level of public support needed to keep them protected? The fixed boundaries that allow wilderness areas to exist may make it difficult if not impossible to adjust to changes in climate and the consequent changes in forest composition and wildlife habitat, not to mention exposing wilderness areas to invasions of non-native species. The spread of the hemlock woolly adelgid (*Adelges tsugae*) in the eastern United States has been spurred by increasingly moderate winters which have had the effect of expanding the pest's range. As it marches northward, it is leaving a trail of dead eastern hemlock (*Tsuga canadensis*) in its wake.

The effects of off-site anthropogenic change will sorely test the rationale for wilderness preservation. To the extent that protected areas lose or experience marked declines in their signature characteristics, whether flora and/or fauna, recreational value is likely to suffer. Imagine the Bob Marshall Wilderness slowly shifting to drought-resistant scrub. Even Randy Weaver would turn away.

As we noted earlier, the scientific value of these areas will remain high, though not for the reasons Leopold and later proponents of wilderness advanced. Baselines are presumed to be stable and self-replicating. If, as most now expect, instability and unpredictability are in our near future, ecologists will have plenty to study, but whatever they uncover will likely not be a guide to Leopold's gold standard--land health.

Wilderness areas will also be compromised as wildlife refugia. Indeed, to the extent that wilderness areas are surrounded by human-dominated landscapes (agriculture, oil and gas installations, and up-scale real estate developments), the wilderness areas may become wildlife traps. With habitat changing and no place to go, wildlife managers will be faced with the goal of maintaining remnant, not robust, populations. This could lead to increasing pressure for the creation of large corridors for connectivity among wild areas that mobile species can utilize.

To some extent, this is already upon us, not because of climate change but, ironically, because wilderness has been, at least for some species, a good refuge--some would say "too good." There are two related issues that have given rise to criticism. The first is well-understood. The density of a species in any given area is a function of resources, space

and tolerance. The general public believes that if there is enough food, animals will stay put. To the extent that a wilderness preserve has a good food supply and good breeding habitat, it can quickly generate dispersal. And before you know it, there will be refugees from the refugia roaming, if you will, off the "reservation."

We are all familiar with the ongoing struggle over the bison (*Bison bison*) in Yellowstone, as well as the ongoing conflict over delisting gray wolves (*Canis lupus*) and the grizzly (*Ursus arctos horribilis*) in Montana, Idaho and Wyoming (Chadwick 2010). Similar conflicts are likely to gain a higher profile in the upper Midwest over steadily increasing numbers of wolves dispersing from their redoubt in northernmost Minnesota. To add to the mix, the first confirmed mountain lion (*Puma concolor*) was caught on monitoring camera in northwestern Wisconsin in mid-December 2009. A Wisconsin Department of Natural Resources (DNR) wildlife expert said what most would likely say: "That (the photo and a confirmed cougar-killed deer near the site of the trail camera) was really cool." (*Milwaukee Journal Sentinel*, December 24, 2009, page A1).

It is exciting to think that creatures such as the wolf and the mountain lion, which we have persecuted for centuries and almost succeeded in extirpating, can rebound, given half a chance. It affirms our deep-seated need to think that nature is resilient. It helps that evidence of such resilience assuages a bad conscience. But more than assuaging guilt is involved. The article announcing confirmation of the mountain lion's presence concluded, quoting the DNR, "The DNR said that cougars typically try to avoid contact with humans. The agency says that the risk of the animal attacking people is very small, but it could happen" (*Milwaukee Journal Sentinel*, December 24, 2009, page A6). This mildly hedged reassurance masks a much larger and more interesting challenge to wilderness as refugia.

Without going into great detail, our understanding of large carnivore behavior has been undergoing as fundamental a reappraisal as have the ecological models of climax and stability. Baron (2003) chronicled how habituation of mountain lions led to conflicts culminating in human fatalities. Similar habituation events have occurred with gray wolves, with the tragic killing of Kenton Carnegie in Saskatchewan a powerful lesson (V. Geist personal communication). The supposed shy traits were considered so common and confirmed by many different observers in separate places and at various times that it came to be taken as "hard wired" prior to these recent events.

This is as true for prey species as it is for predator species. Remember how the behavior of white-tailed deer (*Odocoileus virginianus*) was once described? The once-shy animal can be better described now as a lawn ornament across a broad swath of the nation's suburbs and urban fringes. In an intriguing study, researchers compared two groups of elk in Yellowstone, one group had recently experienced wolf predation and the other group had yet to (Creel et al. 2009). The experienced animals interrupted browsing frequently to check for danger while the naïve animals browsed contentedly. There were other statistically different patterns of behavior between the two groups, differences clearly related to the threat the new wolf population posed. With wolves absent from the park for decades, the elk had to learn (or, if you prefer, relearn) the signs of danger. Then, and only then, do the instinctual responses kick in.

The implications of this are clear. Wildlife leaving wilderness areas will learn that life on the outside is different. Predators, if they are not hunted, will sooner or later become habituated to humans, and when that happens, there will be problems.

Implications for Wildlife Management

Hunters as Wilderness Components

Leopold (1933) postulated that the value of a recreational experience is inversely proportional to the intensity of the management required to produce it. Hence, the "wilder" and more "natural" the hunting experience, the greater the recreational value. This harkens back to the romantic notion of primitivism noted earlier. A true wilderness hunt can be an experience of a lifetime and add value that transcends the hunt itself (McCabe 1999). However, relatively few hunters can afford such an experience. As access to private lands becomes increasingly limited (Bromley and Hauser 1994), the importance of hunter access to public lands becomes magnified. Yet, as noted earlier, the legal concept of wilderness shuns human presence. Ironically, paleoecological findings suggest humans, as hunters, were integral components of pre-Columbian America, the perceived wilderness (Martin and Szuter 1999, McCabe and McCabe 1984). The paradox unfolds as we see that humans may in fact have been keystone species in wild America, management of wilderness wildlife without human hunting as part of the system would be artificial, and wilderness designation makes human entry difficult.

Impact of Wilderness Areas on Conservation Funding

Hunters have been the primary funding source for wildlife conservation in North America (Williams et al. 2009). Expenditures for hunting exceeded $22 billion dollars in 2006 (U.S. Fish and Wildlife Service 2006), more than twice that expended in 1985 ($10,059,386,000; U.S. Fish and Wildlife Service 1988). The percentage of hunters who hunted both public and private lands declined from 31 to 24 percent between 1985 and 2006, while the percentage who hunted only on

public lands remained constant (16 percent:1985; 15 percent:2006; U.S. Fish and Wildlife Service 1988, 2006). The impact of wilderness designation to hunter access and resultant implications to trends in conservation funding should be studied; such information should inform wilderness policy.

Wilderness and Biodiversity Conservation

From a total species diversity perspective, wilderness areas are relatively low. Globally, only 18 percent of plants and 10 percent of terrestrial vertebrates are endemic to individual wildernesses (Mittermeier et al. 2003). This does not mean wilderness areas are not important contributors to biodiversity; the viability of certain species may depend on large areas of land with relatively little human use (Noss 1991). However, it has been argued that wilderness preservation and biodiversity conservation represent separate, distinct and divergent goals that can conflict with one another (Sarkar 1999). The potential tradeoff of biodiversity conservation should be considered and weighed when contemplating wilderness designation.

Population Management

The wilderness ideal of letting nature takes its course with limited human intrusion has been framed earlier as utopian. Anthropogenic impacts are universal (McKibben 2006), and the dynamic (non-Clementsian) nature of ecosystems can make such a choice a dangerous gamble. There certainly is scientific value in observing and understanding these processes over long time periods. However, as wilderness is essentially a human value (Cronon 1995), so is the desired condition of wildlife populations. Active management, whether by hunting, habitat manipulation or a combination of techniques can maintain ungulate and carnivore populations at levels compatible with the landscape and desired by humans. In considering wilderness designation, the consequences of limiting such management must be taken into consideration. Corridors that allow wildlife movement among patches of wild areas can be essential for maintaining viability for populations of certain species and could become critical for climate change adaptation strategies.

Conclusion

The wilderness concept embodies a vision where humans are not a part of nature (Cronon 1995). Wildlife conservation has operated under the premise that humans are active participants in nature, yielding both positive and negative effects. The wilderness and wildlife conservation movements both arose out of human passion and shared many of the foremost advocates. Wildlife conservation has been fueled in large part by the vested self interest of hunters. Would wilderness benefit from greater access and use by hunters, thereby reaping more support from that self interest? Or would this compromise the very notion it is founded on? First and foremost, the recognition that wilderness is a human value construct is essential for looking at wilderness in perspective. A number of questions should be given serious consideration as we frame the future of wilderness in America, including:

- How will wilderness designation affect public support for natural resource conservation overall? Will limited public access create a political backlash or will it engender positive values?
- Is passive management a realistic option for maintaining wilderness under 21st-century conditions? Will passive management result in a reduction in biotic diversity and increased vulnerability to disturbance? Will it result in a decline in ecosystem health or will it provide us unique learning opportunities?
- What are the economic costs of wilderness to wildlife conservation? Will it contribute to a decline in hunting due to lack of access, or provide the ultimate in hunting experiences?
- Are there better options for land conservation than wilderness designation? Can we accomplish the same goals without all the restrictions?
- What would the social and cultural costs of reduced wilderness protection be? Is primitivism of social value in the 21st century or is it a relic of the Romantic Era?
- Perhaps most importantly, what benefits do the American people want from wilderness?

These questions and others will help us understand the role wilderness can and should play in 21st century America.

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Managing Fish, Wildlife and Recreation on Roadless Areas

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What's happening to our wild country… the iconic landscapes that most biologists aspire to explore and study as a lifelong goal? We know the answer—they're vanishing rapidly. Many were developed to meet the needs and desires of a burgeoning human population. Mines, oil and gas fields, agriculture, giant reservoirs, housing projects—you know the story. And if we're brutally honest with ourselves, many of us should admit that we, as most Americans, have contributed to this loss. Population growth, consumption of natural resources and economic development are relentlessly taking a toll on our backcountry and wildlife. Wildlife biologists have done much to avoid, reduce and mitigate the loss of habitat from these activities, but in the end, much of the wildness of North America is lost. Not only have we lost the vast herds of bison, abundant prairie grouse and brown bear observed by Lewis and Clark but even the lands left to us by the foresighted conservation leaders of the 20th Century continue to erode.

Our greatest conservationist president, Theodore Roosevelt, had deeply held views about wild places and species restoration that inspired his revolutionary actions to create millions of acres of national forests, refuges and parks as he famously exclaimed, "I so declare it!" His wild lands philosophy is revealed in his essay "Wilderness Reserves" (Roosevelt 1908): "The wild creatures of the wilderness add to it by their presence a charm which it can acquire in no other way. On every ground it is well for our nation to preserve, not only for the sake of this generation, but above all for the sake of those who come after us, representatives of the stately and beautiful haunters of the wilds which were once found throughout our great forests, over the vast lonely plains, and on the high mountain ranges, but which are now on the point of vanishing save where they are protected in natural breeding grounds and nurseries. The work of preservation must be carried on in such a way as to make it evident that we are working in the interest of the people as a whole, not in the interest of any particular class; that the people benefitted beyond all others are those who dwell nearest to the regions in which the reserves are placed. The movement for the preservation by the nation of sections of the wilderness as national playgrounds is essentially a democratic movement in the interest of all our people."

Thanks to such inspired leadership from Roosevelt and others, there still are some places … special places … that retain the secure habitat that many species require to thrive and the character that many of us crave to explore. The United States has set aside 109 million acres of legislatively established Wilderness, about half of which is located in Alaska. These are the great undeveloped watersheds of more than 5,000 acres in size. But there also are nearly 59 million acres of "roadless" areas open to multiple use, many of which may someday qualify as wilderness but are in a kind of limbo, no-man's land, until the courts or the Congress determine their fate. These are the areas that are in greatest dispute. The question is, should they be retained as wild places or should they be developed as are most public lands? If they are opened to commercial development, what will we lose?

There is no doubt that active habitat management of most of our public lands is necessary to produce the desired diversity and abundance of fish and wildlife in our human-influenced landscape. However, it also is appropriate to conserve *some* wild country habitat in as natural a state as possible by limiting road building. Wilderness and roadless lands, areas of critical environmental concern, and other restricted use areas for fish and wildlife that limit commercial development produce some of the best remaining fish and wildlife habitat and recreation available. Large blocks of intact habitat provide security for big game, and undisturbed streams support wild fish populations that depend on clean water with stable stream flows. While roads and trails are important in most areas for providing access for hunting and fishing, too much development can increase big game vulnerability, fragment habitat and spread invasive species. These impacts can result in fewer mature animals in prime condition, shortened hunting seasons with fewer tags, as well as decreased water quality and quantity that are needed by coldwater fish. Habitat with limited human disturbance provides exceptional hunting and fishing opportunities that are only available in backcountry. By limiting development in some areas and providing opportunities for agencies to actively manage habitat where appropriate, we can have the full complement of accessible habitat across the landscape. Let me explain why I believe it's important to reserve some areas in roadless condition for wildlife management purposes while providing opportunities for quality fish and wildlife recreation. I will describe the extent of roadless areas in the United States--their economic, ecological and wildlife values--and hunter attitudes about them. And I will focus on roadless areas of the National Forest System because they offer the greatest opportunity for policy action and they represent the largest extent of undeveloped federal habitat that is in dispute by conservationists.

Extent of Roadless Areas in the United States

There are 193 million acres of National Forest System (NFS) lands, 58.5 million acres of which are Inventoried Roadless Areas (IRAs) (USDA Forest Service 2000). In the year 2000, there were 2,832 IRAs in the United States comprising 28 percent of all NFS lands and representing about 2 percent of the land base. They are found within 661 of the more than 2,000 major watersheds in the U.S. (U.S. Environmental Protection Agency 1997, Sedell et al. 2000). The National Forest System contains 386,000 miles of roads, about 10 percent of the public road system of the United States. There are approximately another 60,000 miles of "ghost roads" created by illegal off-road vehicles (Forman et al. 2003) that are not maintained by the USDA Forest Service. This has resulted in National Forest System road densities of about 2 to 4 miles of road per square mile of land in federal and private lands studied in the Pacific Northwest (Forman et al. 2003).

Recreational Values of Roadless Areas

Economists have documented the ecological and economic values of wilderness and other wild lands (Loomis and Richardson 2000). They include eight value categories: recreation, community, passive use, scientific, biodiversity, off-site, ecological services and education. They studied 42 million acres of roadless lands on national forests and found that their recreation benefits include opportunities for non-motorized recreation such as hiking, backpacking, hunting and fishing. The average value of roadless areas per recreation day is nearly $42. Maintaining 42 million acres of national forest roadless areas in the conterminous U.S. would support 14.6 million visitor days of non-motorized recreation, valued at $600 million in annual recreation benefits.

As for hunter attitudes toward roads on the national forest, a national survey by the Theodore Roosevelt Conservation Alliance (1999) found that most hunters (85 percent) supported repairing and maintaining existing roads before building new roads on NFS lands, and most hunters (83 percent) supported keeping existing roadless areas in our national forests in their current roadless state. The prevailing message from hunters was, "Leave things as they are now. Don't build new roads into roadless areas, but make sure hunters have access to national forest lands and roadless areas."

Fish, Wildlife and Habitat Values of Roadless Areas

According to the Forest Roads Working Group (2001), "The inventoried roadless areas of the national forests are uniquely important for their ecological diversity; undisturbed soil, water and air resources; habitat for both managed and vulnerable fish and wildlife species; dispersed recreation opportunities; scenic landscapes; and traditional cultural properties and sacred sites."

At the state level, the Montana Department of Fish, Wildlife and Parks (2005) has found that roadless areas provide undisturbed blocks of habitat; strongholds for wildlife, including endangered species; high-quality habitat that provides seasonal needs of wild ungulates; habitat security for hunted populations; balanced age structure for elk; extended hunting seasons; and increased economic activity associated with hunting, fishing and wildlife-related recreation.

Watershed Values

Roadless areas provide clean, high-quality water for fish and wildlife (Furniss et al.1991; USDA Forest Service 2000). Effects of roading can potentially include:

- increasing sediment loads, especially harmful fine sediments, in streams;
- modifying watershed hydrology and altering stream flows;
- altering stream channels;
- degrading water quality;
- altering water temperature;
- fragmenting habitat and preventing access to upstream habitat; and
- increasing access to streams, which may facilitate increased angling mortality on fish, spread of disease (e.g., whirling disease) and introduction of aquatic nuisance and non-native species.

Native Plant Communities. Many roadless areas provide undisturbed habitat that supports a wide variety of native plants. Compared with roaded areas, native plant communities in many unroaded areas are more intact because exotic species are less likely to become introduced or established from road construction and use. Disturbance of soils by vehicles has long-term effects that favor the establishment of weedy species (Blackburn and Davis 1994). After disturbance, exotic species often displace native vegetation.

Insects. One subject of great controversy is how to manage roadless area forests in the face of extensive bug kill. Insect infestations such as bark beetle epidemics are sometimes cited as a reason to enter roadless areas to apply mechanical treatments to control outbreaks. However, a recent literature review concerning Colorado lodgepole pine and spruce-fire forests (Black et al. 2010) offers some new insights that silvicultural treatments may not reduce forest susceptibility to insect spread or reduce the risk of fire as previously thought. Among the findings of these scientists were:

- insect outbreaks and fires are part of the ecology of many western forests;
- ongoing outbreaks of insects may be caused by climate;
- insect outbreaks in roadless areas are not likely to heighten fire risk in adjacent communities, rather, it is the presence of both living and dead vegetation near homes that determines the risk;
- tree harvest is not likely to control ongoing bark beetle outbreaks or other insect species;
- thinning in roadless areas is not likely to alleviate future large-scale epidemics of bark beetle; and
- native forests may eventually return following insect outbreaks in most locations.

Endangered Species. Roadless areas often are strongholds for sensitive wildlife populations. Nationwide, more than 55 percent of threatened, endangered and candidate species use habitat on or associated with roadless areas. According to the USDA Forest Service, inventoried roadless areas help maintain viable populations of federally listed species such as grizzly bear, gray wolf, Canada lynx and bull trout.

With regard to grizzly bears and roads, researchers and wildlife managers find that areas without motorized access during the non-denning period are important to grizzly bears and that bears avoid habitats near roads. In fact, the Interagency Grizzly Bear Committee (IGBC) adopted the criterion of "a minimum distance of .3 miles from any open road or motorized trail" for core habitat areas for grizzly bears (IGBC 1994).

Roadless areas provide important habitat, refugia and strongholds for sensitive fish species such as arctic grayling, westslope cutthroat trout and Yellowstone cutthroat trout. They also minimize development conflicts because roadless areas have fewer restrictions imposed to protect threatened, endangered, or candidate species or their habitats.

Game and Fish Species. Roadless areas also provide high-quality wildlife habitat for game species. Roadless areas contribute substantially to the seasonal nutritional needs of wild ungulates because disturbance is less likely to occur in these environments, thus avoiding loss of foraging and other seasonal life cycle activities, displacement, interference with adaptations, induced stress and consequences of unnecessary energy consumption on breeding success (Canfield et al. 1999). It has been repeatedly documented throughout North American elk range that vehicle traffic on forest roads is avoided by elk. Even though the habitat near forest roads is available to elk, it may not be used due to road disturbance. In Montana, studies have demonstrated that reductions in habitat use by elk are usually confined within 0.5 mile of roads, but declines in elk use have been detected as far as 2 miles from open roads. Elk habitat effectiveness can be expected to decline by one-fourth when open road densities are 1 mile per square mile and by one-half when road densities are 2 miles per square mile (Montana Department of Fish, Wildlife and Parks 1984).

Habitat security for hunted populations is also affected by roads. An increase in stress or disturbance is associated with the hunting season or other human activities (Lyon and Christensen 1992). Poor elk security can result in redistribution of elk from public lands to private lands during the hunting season, or overharvest of bulls.

Furthermore, roads can affect the sex and age structure of hunted wildlife populations. Roadless areas tend to provide for balanced bull age structure for elk, with some bulls living in excess of 10 years and more than 30 percent of the bull population consisting of mature animals. Bull:cow ratios are also affected by access-related hunting mortality rates. In highly roaded areas, one study found fewer than 10 bulls per l00 cows and only 1.3 mature bulls per l00 cows. Closing roads boosted sex ratios to nearly 20 bulls per l00 cows, and the unroaded treatment had 34.5 bulls per 100 cows. In addition, roadless areas may contribute to longer general elk and deer hunting seasons. Maintenance of secure cover in roadless areas allows Montana to maintain a five-week general bull elk hunting season.

With regard to elk vulnerability, bull elk in roaded habitats are more than twice as likely to be killed during fall hunting seasons as those in areas with very few roads (Unsworth and Kuck 1991). A direct relationship exists between levels of road access and bull mortality, with mortality increasing with increased road density (Unsworth and Kuck 1991, Leptich and Zager 1991).

For game fish, roads can cause direct or indirect changes in streams that affect food, shelter, spawning sites, water quality, and migration barriers for trout and salmon. (Furness et al. 1991, USDA Forest Service 2003). For example, bull trout are extremely sensitive to the direct, indirect and cumulative effects of roads. According to the USDA Forest Service, conservation of bull trout should involve protection of larger, less fragmented and less disturbed (lower road density) habitats to maintain important strongholds and sources for naturally re-colonizing areas where populations have been lost (USDA Forest Service 2000).

Summary

While biologists and managers recognize the importance of applying active management practices on public lands to gain a wide range of social and economic benefits, there also are good reasons for a more passive approach to the stewardship of our backcountry. There will be situations where limited human intervention should be considered for purposes such as managing fire-dependent systems. But the many unique recreational, ecological, and fish and wildlife values and services provided by roadless areas warrant conservation policies and practices that sustain them. As Aldo Leopold wisely wrote, "I am glad I shall never be young without wild country to be young in. Of what avail are forty freedoms without a blank spot on the map?"

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Constant Change: Bird Conservation on Grassland and Early Successional Forest Landscapes

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Throughout time across North America, disturbance events have shaped the composition, structure and distribution of wildlife habitats and, therefore, wildlife populations. All natural landscapes and associated wildlife populations were and remain subject to the effects of disturbance. Changes in disturbance regimes beyond the range of natural variability due to man's actions, or the lack thereof, can affect the sustainability of wildlife populations on altered landscapes. Where such changes are occurring today, society must recognize and support the need to better replicate the effects of natural disturbance on the distribution and abundance of wildlife habitats and populations through targeted management actions at appropriate spatial and temporal scales.

Historical Role of Disturbance

Disturbance agents historically affecting vegetation communities included fire, wind, ice storms, disease, insect infestation and grazing. A primary disturbance agent on most landscapes was fire of natural or aboriginal origin. The frequency, intensity, extent and effects of wind (Canham and Loucks 1984) and fire (Heinselman 1973, Ahlgren 1974, Clark 1990) disturbance events are variable. Soil texture and drainage (Whitney 1982, Leitner et al.1991), local topography (Grimm 1984) and climate (Swain 1978, Clark 1990) influence the degree to which a landscape may be affected by fire or wind.

Prior to settlement of the Americas by Europeans, Native American populations commonly utilized fire to modify the natural landscape for many purposes. Local impacts were extensive in some regions due to the widespread use of fire to promote preferred plant and animal foods (Day 1953, Stewart 1956, Little 1974).

The introduction of disease to the New World by European explorers in the 16th Century, such as typhus, bubonic plague, measles, influenza and, in particular, smallpox, against which Native American populations had little or no immunity (the mortality rate for the smallpox virus was estimated at 75 to 95 percent) decimated existing populations (Crosby 1972, Thornton 1987). Significant reductions in Native American populations likely led to concomitant reductions of anthropogenic fire and its effects on vegetation and, therefore, wildlife. The subsequent conversion of forests by European settlers to homesteads, agricultural lands and communities in the 18th and 19th Centuries increased the abundance of open lands and associated wildlife.

Since the early 20th Century, society has worked to minimize the effects of fire on the landscape through rigorous suppression in an effort to safeguard lives and property. These suppression efforts have been largely successful in the forests of the eastern United States and the grasslands of the central portion of the nation. Wildfire remains a dominant force affecting the vegetative landscape of the western United States, and prescribed fire is an important tool in the management of pine forest communities in the Southeast.

Land management practices used today that can to some degree mimic the effects of historic fires on grasslands and forests include prescribed burning and forest management. These practices can establish and sustain wildlife habitats similar to those resulting from historic fires. However, due to landscape fragmentation and societal attitudes, the spatial scale of these management actions is substantially reduced from historic norms.

Current Bird Habitat Conditions

Grassland Habitats

Sampson and Knopf (1994) suggest that native prairies are the most endangered ecosystem in North America. Historically, approximately 300 million acres (121 million ha) of tall, mixed and shortgrass prairie blanketed the central United States (Vodehnal and Haufler 2007). Fire, drought and grazing by wild herbivores precluded the establishment of woody vegetation and sustained these grasslands through time (Campbell et al. 1994, Bragg 1995). Precise estimates of the area that today supports functional grassland ecosystems are difficult to attain. Although coarse-scale resource inventories can provide estimates of area covered by grasslands, these inventories do not necessarily yield insight into the ecological condition of these grasslands, which may be severely compromised due to excessive grazing by domestic livestock or the presence of invasive species. Still, the loss of functional grassland ecosystems over time has been dramatic. Dahl and Johnson (1991) found that less than 1 percent of native prairies still exist in the prairie pothole region

(Bird Conservation Region [BCR] 11) and only 0.01 to 0.02 percent of historic native tallgrass prairie still exists in Illinois, Indiana and Iowa (Whitney 1994). During the interval 1982 to 2002, grassland habitats in the United States declined by 33 million acres (13 million ha) (USDA Natural Resources Conservation Service 2004).

Primary factors responsible for grassland loss over time include conversion to agriculture, urban and rural development, fragmentation, and the interruption of historic disturbance regimes. Additional potential future threats, such as changes to federal agricultural policies, wind energy development and biomass production, could further complicate efforts to conserve grasslands and grassland birds.

Existing grassland habitats are sustained through the use of prescribed fire and controlled grazing. Prescribed fire on public grasslands has declined in recent years in part due to the increasing use of limited fire management funding to implement hazardous fuel reduction projects, particularly within the wildland/urban interface. In the Western North Dakota Fire District, annual acreage burned through prescribed fire has declined by approximately 28 percent since the late 1990s (U.S. Fish and Wildlife Service [USFWS] unpublished data).

Early Successional Forest Habitats in the East

In February, 2007, the American Bird Conservancy classified early successional deciduous forest habitats in the eastern United States as one of the nation's 20 most threatened bird habitats. Historically, the existence of a spatially stable matrix of forest types and age-class conditions across time is unlikely (Dessecker 1997). Throughout the eastern United States today, young (1 to 20 years old) deciduous forest habitats have decreased by 33 percent over the past several decades, while total forest land has increased by approximately 7 percent (USDA Forest Service 2010). Declines in early successional forest habitats vary by region. These habitats have increased as a result of recent increases in forest harvest in northern New England and the western Great Lakes region but have decreased throughout much of the remainder of the East.

In the absence of fire, early successional forest habitats are sustained primarily through the natural succession of open lands to shrub-dominated fields or through the use of silvicultural treatments in existing forest stands. Even-age silvicultural systems (clearcut, seed tree, two-aged, shelterwood) are the most appropriate methods to create early successional forest habitats (Thompson and Dessecker 1997). Acreage treated using even-age silvicultural prescriptions on National Forests in the East has declined by 52 percent since 1995 (USDA Forest Service unpublished data). Approximately 70 percent of our eastern forests are controlled by nonindustrial private forest landowners. Data on the use of silvicultural prescriptions on private ownerships are largely unavailable, but the decline of early successional habitats across the landscape irrespective of ownership classification suggests a decline in their use on these ownerships as well. In addition, Birch (1986) and Roberts et al. (1986) reported that as the size of nonindustrial private forest tracts decreases, so too does the likelihood of timber harvest activity. Birch (1996) documented that privately owned forest tracts less than 100 acres (40 ha) increased from 30 million acres (12. million ha) (26.7 percent of private forest land) in 1978 to 57 million acres (23 million ha) (43.6 percent of private forest land) in 1994.

Current Breeding Bird Trends

Due to varying environmental conditions and variable ecological requirements, it is unlikely for all breeding bird species on a given landscape to concurrently experience uniform population increases or decreases. In the absence of some uncharacteristically severe alteration to landscape conditions, random chance suggests that approximately one-third of breeding species will be experiencing population increases, one-third of breeding species will be experiencing population decreases, and the populations of the remaining one-third will be stable. Significant deviation from this expected ratio suggests that one or more habitat or ecological condition may be increasingly rare or absent, thereby negatively affecting birds that utilize similar habitats or are representative of specific guilds (e.g., ground-nesting birds, bark foragers).

Grassland Birds

Grassland birds currently federally listed under the Endangered Species Act (ESA) include the endangered Attwater's prairie chicken (*Tympanuchus cupido attwateri*) and the candidate lesser prairie chicken (*Tympanuchus pallidicinctus*) (there are several additional midwestern bird species listed under ESA that require a mosaic of grassland and wetland habitats). The greater prairie chicken (*Tympanuchus cupido*) and sharp-tailed grouse (*Tympanuchus phasianellus)* are important game species in several midwestern and western states. Populations of these two game birds have declined precipitously from historic levels (Vodehnal and Haufler 2007). Breeding Bird Survey (BBS) data (1966 to 2007) document that within the four BCRs that comprise the majority of the nation's midwestern grasslands (BCR 11, 17, 18, 19), the number of grassland bird species that are experiencing population declines far exceeds the number that are increasing (Figure 1). Conversely, within this same landscape and interval, the number of bird species that breed primarily

in shrub-dominated habitats that are experiencing population increases far exceeds the number that are declining (Figure 2). In addition, these data document that grassland birds in the eastern United States are experiencing precipitous population declines.

Figure 1. Comparison of the proportion of bird species that breed in grassland habitats that are increasing and the proportion that are decreasing (Breeding Bird Survey data 1966 to 2007).

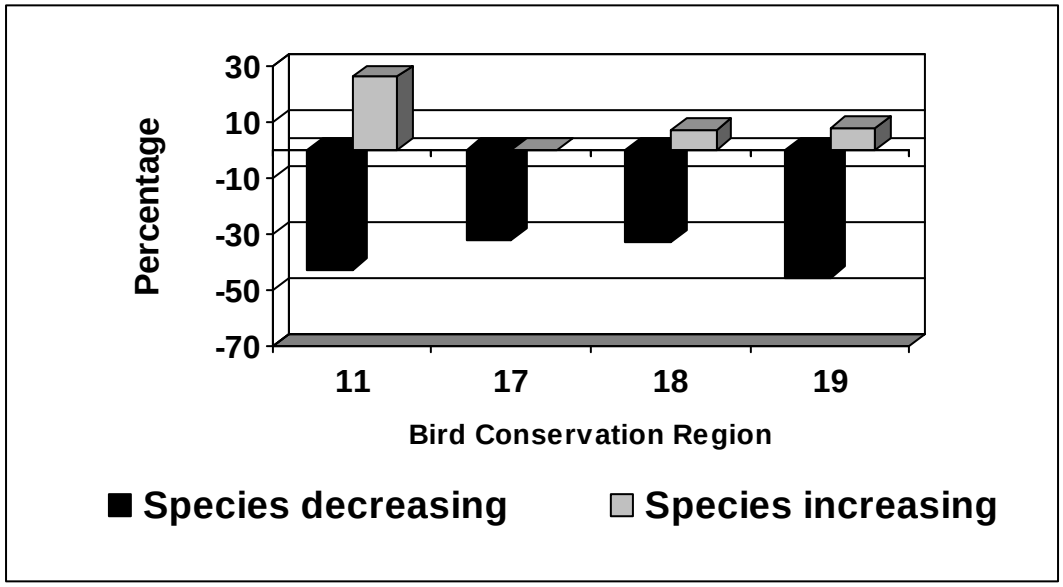
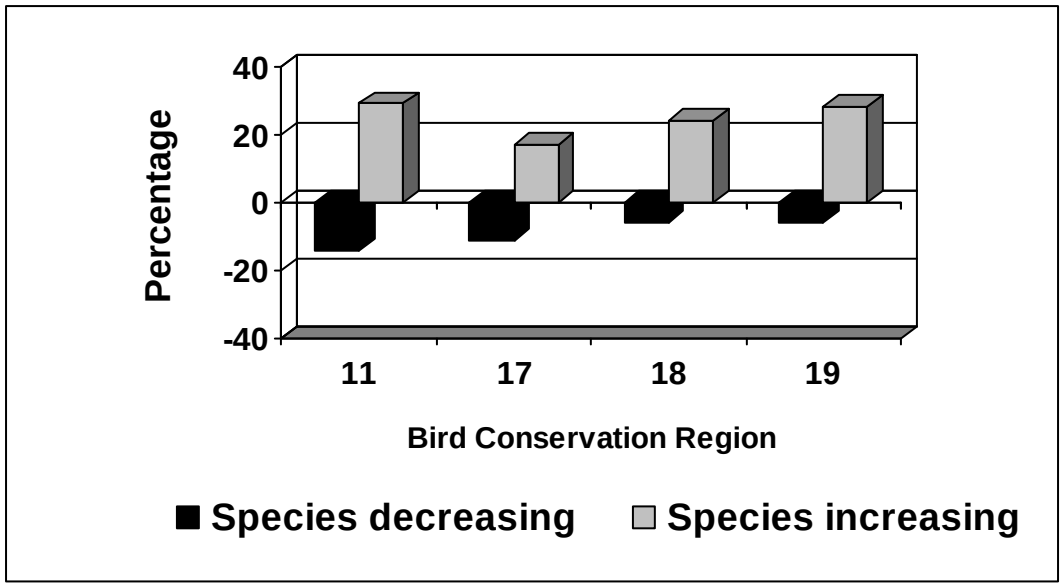


Figure 2. Comparison of the proportion of bird species that breed in shrub-dominated habitats that are increasing and the proportion that are decreasing (Breeding Bird Survey data 1966 to 2007).



The expansion of shrubs and trees into grasslands can negatively affect many grassland bird species (Bakker et al. 2002). Grant et al. (2004) found that as woodland cover increased, the presence of grassland birds declined. Species found to be sensitive to the encroachment of woody vegetation include Baird's sparrow (*Ammodramus bairdii*), Sprague's pipit (*Anthus spragueii*), chestnut-collared longspur (*Calcarius ornatus*) and grasshopper sparrow (*Ammodramus savannarum*); all of which are classified as high conservation priority by Partners in Flight in at least one grassland BCR. The probability of occurrence of three species, savannah sparrow (*Passerculus sandwichensis*), bobolink (*Dolichonyx oryzivorus*) and grasshopper sparrow, declined from greater than 80 percent to 50 percent where woody vegetation covered only 10 to 25 percent of the landscape. The continuing loss of grassland habitats through land-use conversion and

the continued fragmentation of these habitats through the encroachment of woody vegetation will complicate efforts to conserve associated bird species.

Birds of Early Successional Forest Habitats in the East

Birds of shrub-dominated or young forest habitats in the eastern United States that are currently federally listed under ESA include the endangered Kirtland's warbler (*Dendroica kirtlandii*) and black-capped vireo (*Vireo atricapilla*) and the threatened Florida scrub jay (*Aphelocoma coerulescens*). The ruffed grouse (*Bonasa umbellus*), bobwhite quail (*Colinus virginianus*) and American woodcock (*Scolopax minor*) are important game birds throughout much of the eastern United States. These three species are experiencing population declines throughout significant portions of this region (Dimmick et al. 2002, Dessecker and McAuley 2004, Cooper and Parker 2009). Since the mid-1960s, the ruffed grouse population in Indiana, which is at the southern edge of the species' range, has declined by 98 percent (Backs 2009). BBS data (1966 to 2007) document that the number of bird species characteristic of these habitats that are experiencing population declines exceeds the number that are increasing (Figure 3). Conversely, within this same landscape and interval, the number of bird species characteristic of mature forest habitats that are experiencing population increases exceeds the number that are declining (Figure 4).

Figure 3. Comparison of the proportion of bird species that breed in shrub-dominated or young forest habitats that are increasing and the proportion that are decreasing (Breeding Bird Survey data 1966 to 2007).

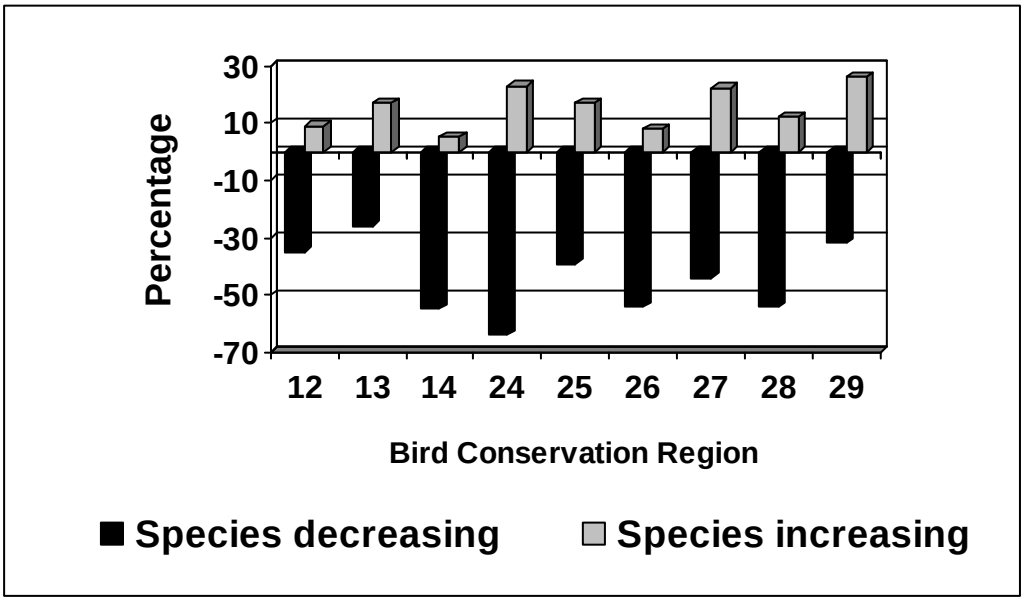
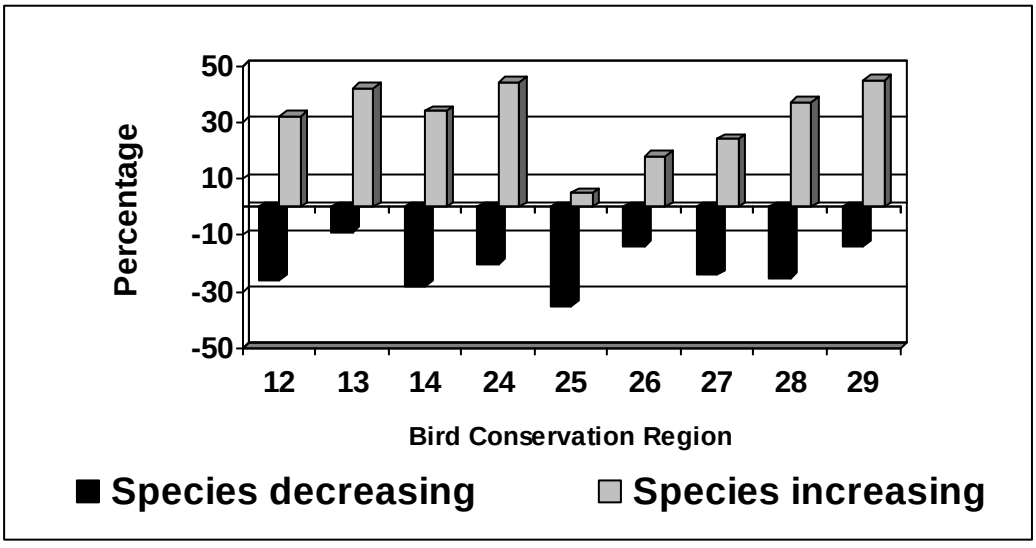


Figure 4. Comparison of the proportion of bird species that breed in mature forest habitats that are increasing and the proportion that are decreasing (Breeding Bird Survey data 1966 to 2007).



Many bird species that depend upon these early successional forest habitats are experiencing population declines as a result of the ongoing maturation of our eastern deciduous forests and the loss of shrub-dominated habitats through succession (Hunter et al. 2001). Species characteristic of shrub-dominated or young forest habitats in the eastern United States that are classified as high conservation priority in at least one BCR by Partners in Flight include the golden-winged warbler (*Vermivora chrysoptera*) (petitioned for federal listing under the ESA in February 2010), whip-poor-will (*Caprimulgus vociferous*), American woodcock and yellow-breasted chat (*Icteria virens*).

Due to the ephemeral nature of young forest habitats, breeding bird use of these habitats may last only a few years. Schlossberg and King (2009) found that 13 bird species characteristic of young forest habitats attained their highest population densities in regenerating forest stands less than 10 years old. Breeding densities of golden-winged warblers were highest in aspen stands less than 10 years old in northern Wisconsin (Roth and Lutz 2004, Martin et al. 2007). The relatively brief period of time that young forests provide optimum habitat conditions for some bird species necessitates the regular development of these habitats through targeted even-aged silvicultural prescriptions.

The presence of early successional habitats in a predominantly forested landscape can benefit some bird species that breed in mature forests by providing nesting habitat, protective cover and foraging habitat for juveniles without increasing nest predation or parasitism (Thompson et al. 1996, Donovan et al. 1997). Stoleson (in review) documented nest densities for Partners in Flight priority bird species in recent shelterwood treatments and uncut mature mixed-oak stands in Pennsylvania. Nest densities for three species commonly associated with mature forests were higher in the shelterwood treatments than in the uncut control stands (cerulean warbler [*Dendroica cerulean*], hooded warbler [*Wilsonia citrine*], eastern wood pewee [*Contopus virens*]). Nest densities for four other mature forest birds did not differ between treatment and control plots. Preferential use of early successional forests as postfledging habitat by juvenile wood thrushes (*Hylocichla mustelina*) has been documented in Virginia (Vega Rivera 1998), and by juvenile wood thrushes and worm-eating warblers (*Helmitheros vermivorus*) in Missouri (Pagen et al. 2000).

Public attitudes toward the use of silvicultural treatments may continue to limit efforts to conserve bird species that depend upon shrub-dominated and young forest habitats. These attitudes are largely driven by aesthetic considerations, but they can be modified by enhancing public understanding of the ecological role of these treatments (McCool et al. 1986, Vodak et al. 1988).

Conclusion

Providing for the habitat needs of grassland and early successional forest birds is an essential element of comprehensive, all-bird conservation strategies. These comprehensive strategies will be guided by recommendations developed through recovery plans for federally listed species, BCR-specific Conservation Plans, State Wildlife Action Plans and plans addressing the conservation of individual species or groups of closely related species (e.g., Ruffed Grouse Conservation Plan, Grassland Conservation Plan for Prairie Grouse, American Woodcock Conservation Plan).

Societal input is increasingly driving land and natural resource management decision-making processes affecting our nation's public lands. Unfortunately, the proportion of the United States population that resides in metropolitan areas (areas with a population greater than 50,000) and has little day-to-day interaction with natural ecological systems has risen from 56 percent in 1950 to 82 percent in 2000 (U.S. Census Bureau 1987, 2010) and is projected to continue to rise. Aldo Leopold (1966: 6) eloquently summarized the disconnect between society and the natural world that can occur as a result of an increasingly urban society: "There are two spiritual dangers in not owning a farm. One is the danger of supposing that breakfast comes from the grocery, and the other that heat comes from the furnace."

A primary challenge faced by natural resource professionals today is to enhance the understanding of an increasingly nature-deficient public of the critical role played by natural and anthropogenic disturbance in the conservation of wildlife. The public must be helped to better understand that there are very real consequences to wildlife from decisions to *not* impart a particular habitat management action on a particular landscape. The public must be helped to better understand that the long-term implications of inaction must be given equal consideration in decision-making processes to the potential short-term implications of action. The failure to affect this enhanced understanding will seriously compromise efforts to conserve game and nongame wildlife associated with habitats sustained only through periodic disturbance.

As the structure of a government gives force to public opinion, it is essential that public opinion be enlightened accordingly. (Inscription on the dome of the Missouri State Capitol building.)

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Special Land Designations and Implications for State Fish and Wildlife Agencies

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The State Fish and Wildlife Agency Mission

The state fish and wildlife agencies are responsible for fish and wildlife management within their borders, even on most federal public lands. This responsibility is reflected in several federal statutes and policies concerning fish and wildlife conservation and federal public land management. National guidance (e.g., legislation, proclamations) for special land designations (e.g., wilderness, wilderness study areas, monuments, roadless areas, critical habitat, etc.) do not generally seek to diminish the states' role with respect to fish and wildlife management; however, special land designations can have negative consequences for state fish and wildlife agencies.

Special Land Designations–Implications for State Fish and Wildlife Agencies

The state fish and wildlife agencies value the need to conserve landscapes for fish and wildlife populations; however, while special land designations may ensure protection of habitats from the impacts of development or other disturbances, they also can limit fish and wildlife management by: restricting access for wildlife management and habitat enhancement projects; impacting harvest objectives from reduced public access; redirecting and concentrating public uses on adjacent lands; and requiring the state fish and wildlife agencies to divert time and expertise from constructive, on-the-ground projects, to the planning and protection of reasonable access for fish and wildlife management and wildlife-related recreation. All of these impacts result in decreased capacity for effective management of fish and wildlife resources on public land. Restrictions to access and proactive fish and wildlife management caused by special land designations can impact the states' authorities, cost the states time and dollars, and impact the states' fish and wildlife resources.

State fish and wildlife agencies generally are not categorically opposed to all special land designations. However, many are concerned about the federal land management agencies' interpretation and implementation of special land designation laws. Inappropriate and/or inconsistent interpretation of special land designation laws has resulted in conflict and delay of fish and wildlife management efforts in some western states. In addition, interpretations by special interest groups, who regard certain fish and wildlife management activities as a violation of special land designation policy, have halted the implementation of important projects. This conflict and delay in fish and wildlife management activities, especially when those activities are necessary to maintain the fish and wildlife populations for which special designations are established, is of great concern to some state fish and wildlife agencies.

Impacts to Fish and Wildlife Management

Special land designations that prohibit motorized or mechanized equipment and access by motor vehicles or aircraft can have serious adverse impacts to the states' fish and wildlife management responsibilities and programs. Special land designations do not necessarily ensure the continued well-being of fish and wildlife populations, nor eliminate the effects that adverse factors will have on these resources. In some states, a hands-off, preservationist approach to maintaining biological diversity is not a feasible option. Active fish and wildlife management often will be necessary to maintain and enhance the fish and wildlife values for which special designations are established. Special land designations can prohibit or restrict important fish and wildlife management actions, including: fish and wildlife population management and research; release of wildlife into currently unoccupied habitats; fish stockings and stream renovations; habitat improvement projects; maintenance of existing wildlife water developments; construction of new wildlife water developments; and fish and wildlife law enforcement actions.

Special land designation proposals generally identify the uniqueness of specific fish and wildlife habitats and species associated with the area receiving special designation. In many cases, the species that are highlighted in these proposals are considered sensitive and/or rare, and require monitoring and proactive management actions to study population trends and maintain and enhance habitat conditions. To conserve and enhance fish and wildlife resources, the states must continue to have the ability to implement necessary fish and wildlife management actions that support existing, reintroduced, supplemented or expanded populations of fish and wildlife.

Impacts to Public Access and Hunting and Fishing Opportunities

Special land designations have eliminated or restricted reasonable public access and hunting and fishing opportunities in some states. The state fish and wildlife agencies use big game hunts and hunters to achieve harvest objectives and population goals. Special land designations can restrict public access, diminish hunting opportunities and limit the states' abilities to accomplish important big game harvest objectives. In addition, special land designations in some western states have further decreased hunting opportunities due to opposition of hunting and restrictions on motorized access and mechanical transport (e.g., game carriers) for the retrieval of downed big game.

These impacts to public access and hunting opportunities have the real potential to be inconsistent with the North American Model of Wildlife Conservation, which strives to conserve fish and wildlife and their habitats and perpetuate hunting and fishing for future generations. Hunting and angling are the cornerstones of the model; these activities continue to be the primary source of funding for conservation efforts in North America, including the conservation of nongame fish and wildlife species that many special designations seek to protect. Some state fish and wildlife agencies are concerned about the effects of special land designations on hunting, fishing, wildlife conservation and the North American Model of Wildlife Conservation, and request serious consideration of public access opportunities for hunters and anglers during development of special land designation proposals and management plans.

Impacts to State Fish and Wildlife Agency Resources

Special land designations can create an unnecessary burden on limited staff resources by requiring the state fish and wildlife agencies to divert time, expertise and work on fish and wildlife conservation to debating and protecting reasonable access for fish and wildlife management and hunting and fishing opportunities. For example, staff efforts to negotiate an agreement with respect to wildlife management and public access because of a special land designation can take several years. Furthermore, state fish and wildlife agency staff time associated with such negotiations is often supported by funding generated by sportsmen that would otherwise be used for fish and wildlife management purposes. This work to preserve the states' authorities and responsibilities ultimately leads to decreased effectiveness and efficiency in managing fish and wildlife resources.

Some state fish and wildlife agencies spend a considerable amount of time planning and completing multiple layers of environmental compliance documentation because of special land designations. Opposition by special interest groups has complicated and delayed these environmental compliance processes. Views regarding special land designations and associated fish and wildlife management and public access will continue to be contentious and controversial among land and resource management agencies, special interest groups, and the public. As a result, fish and wildlife management is delayed, and the appropriateness of certain fish and wildlife management activities is decided by litigation. This situation leads to decreased effectiveness and efficiency in managing fish and wildlife resources.

An additional costly burden often not accounted for is the fact that special land designations can complicate land management, multiple use and access on adjacent lands. The concentration of fish and wildlife-related recreation in ever-smaller areas, the hampered ability to manage fish and wildlife populations and their habitats, and the loss of access to and on adjacent public lands all result in more conflicts and reduced capacity for managing fish and wildlife resources.

Federal Planning Processes for Special Land Designations

State fish and wildlife agencies seek a more consistent and meaningful role in federal planning processes associated with special land designations. The negative consequences of special land designations can be minimized through meaningful coordination with the state fish and wildlife agencies early in the process of developing proposals. This level of state/federal agency cooperation can facilitate development of special land designation proposals and management plans that meet the agencies' respective statutory obligations and management goals, and advance sound conservation of fish and wildlife resources.

The states are not nongovernmental organizations (NGOs). For some states, one of the most significant concerns has been that the federal land management agencies often coordinate with the states at the same level at which they coordinate and discuss issues with the NGOs and the public, and that coordination with the states has not always been meaningful. The states firmly hold that, because of our statutory responsibilities for fish and wildlife management, federal agencies should have a government-to-government relationship with the state fish and wildlife agencies.

In 2002, the U.S. Fish and Wildlife Service (Service) and the state fish and wildlife agencies agreed on a cooperative planning process to fully engage the states in the development of national wildlife refuge policies. Several state fish and wildlife agencies, as a workgroup representing all the states, entered into Intergovernmental Personnel Act agreements with the Service to develop refuge policies. In addition to cooperative work on policies, the states worked with the Service to develop and provide specific internal direction to staff that clarifies the states' role in the management of fish and wildlife populations on refuges. This direction was incorporated into each new refuge policy, communicated

through Service directors' orders, and ultimately affirmed in policy (Service Policy—"Coordination and Cooperative Work with State Fish and Wildlife Agencies"). The Service's action to involve the states in the development of refuge policies as a true statutory partner provides a model for the level of state/federal agency cooperation the states are seeking at the national level on legislation and policy related to special land designations. This action would facilitate state/federal agency cooperation at the local level and meaningful cooperative work during development of special land management plans.

The "Policies and Guidelines for Fish and Wildlife Management in National Forest and Bureau of Land Management Wilderness" (amended June 2006)–a cooperative agreement between the Association of Fish and Wildlife Agencies, Bureau of Land Management and USDA Forest Service–provides a model for the level of state/federal agency guidance that may be appropriate at the national level with respect to special land designations.

Long-term Challenges – State and Federal Cooperation

Federal agency action to involve the states in the development of special land designation proposals will provide opportunities to overcome difficult challenges related to developing plans that the federal agencies and the states can support. These challenges include: establishing and maintaining strong partnerships necessary to effectively manage fish and wildlife populations; minimizing state/federal jurisdictional debates that delay implementation of fish and wildlife projects; ensuring application of professional and consistent philosophies to designations and management plans, particularly with respect to hunting, fishing, and proactive fish and wildlife projects; and obtaining national and state guidance for federal agency work on special land designations.

Establishing and Maintaining Strong Partnerships

In order for any cooperative approach on special land designations to be successful, the federal and state agencies, at all levels, must be committed to building trust relationships and strong partnerships. Taking the time to develop meaningful partnerships would facilitate more efficient and effective state/federal agency planning efforts. The states and federal land management agencies need to work together to complement both agencies' responsibilities for the conservation of fish and wildlife resources on federal public lands.

State/Federal Agency Jurisdictional Debates

Management planning efforts in some states have been delayed for several years because the federal land management agencies can't move beyond the debate regarding which agency calls the shots. There needs to be a commitment between the agencies that, if differences can't be resolved at the local level, then they will be elevated through the chain of command for resolution. The federal land management agencies and the states need to work together, focus on common goals and objectives, resolve conflicts, and develop and implement management plans that both agencies can support.

Philosophies on Special Land Designations and Management Plans

The overlay of special land designation policy and philosophy on federal public land management, and the associated impacts to wildlife management and hunting and fishing opportunities, is of continuing concern to some state fish and wildlife agencies. In some western states, different federal agencies and individuals in those agencies have interpreted legislative policy or direction associated with special land designations differently. One office or individual may be permissive in interpreting this direction, while the next may be extremely restrictive. In addition, there has been a lack of federal agency recognition and respect of the state fish and wildlife agencies' role in some special land designation processes. This is due, in large part, to the lack of consideration of fish and wildlife resources as important "special resources" when compared with "solitude," "primitive and unconfined recreation," "naturalness," etc. This leads to inconsistent views within and among the federal land management agencies regarding the priority of fish and wildlife management in special designation areas. This occurs even with policy guidelines in place that describe the importance of fish and wildlife management and the commitment of the federal agencies to coordinate closely with the state fish and wildlife agencies.

Special land designation policy and philosophy have caused significant delays in land and resource planning efforts in some states. Wilderness policy has precluded discussions regarding necessary fish and wildlife habitat conservation projects and, in some cases, expansion of hunting opportunities. Opposition by certain special interest groups, who regard wildlife management activities as a violation of special land designation policy, has halted the implementation of important wildlife projects. Litigation and appeals have further complicated and delayed state fish and wildlife management activities. Fish and wildlife populations are important components of most special designation areas, and the states believe that wildlife management can continue to fulfill specific fish and wildlife conservation

purposes while also maintaining other special designation values and purposes. Active fish and wildlife management and special land designations do not have to be incompatible with one another.

Lack of National and State Guidance or Policy for Federal Agencies

Without national and/or state guidance specific to special land designations and fish and wildlife management, fish and wildlife will continue to be prioritized, considered and/or evaluated at a lower level than other values that are supported by extensive national guidance, such as wilderness values. At the state level, planning documents must be clear in their intent such that federal agency personnel, as well as special interest groups and the general public, can interpret decisions or direction consistently. Policy and guidance associated with special land designations should include clarifying language that defines federal agency policies, priorities and direction to avoid future misinterpretation of how decisions should be made and implemented on the ground, or how proposed actions may or may not be consistent with overarching land and resource management plans. Federal guidelines related to special land designations should address wildlife management and clarify how future decisions will be made and how those decisions will affect other resources and uses. In addition, federal guidance should reaffirm the states' wildlife management responsibilities on federal public land, including special designation areas.

Summary – Perspectives on Special Land Designations and Management Plans

Special land designations do not necessarily ensure the continued well-being of fish and wildlife populations nor eliminate the impacts that outside factors will have on fish and wildlife resources. In most cases, active fish and wildlife management will be necessary to maintain and/or enhance the specific fish and wildlife resources and values that special land designations generally seek to preserve. Static and climax communities often are less productive for diverse species assemblages than are managed lands.

Special land designations can restrict fish and wildlife management and public access opportunities and create an unnecessary burden on limited staff resources by requiring the state fish and wildlife agencies to divert time and expertise from constructive, on-the-ground projects, to the planning and protection of state authorities and access for fish and wildlife management and hunting and fishing opportunities. Some state fish and wildlife agencies have faced serious problems when proposing necessary fish and wildlife projects in special designation areas, including: inconsistent and seemingly inappropriate interpretations of special land designation policy language (e.g., Wilderness Act language) by the federal agencies that conflict with the states' wildlife management responsibilities; lack of overarching federal agency policies to guide coordination of planning processes and projects with the state fish and wildlife agencies. Existing guidance for wildlife management is subject to a wide range of interpretation and is seldom referenced, which leads to conflict and inconsistent approaches between agencies; the misuse of special land designation policy language by special interest groups, who regard certain fish and wildlife management activities as a violation of special land designation policy, has proven effective at stalling and halting fish and wildlife projects, even those projects that are necessary to enhance the natural resources targeted by the special designation. Associated litigation and appeals have also stalled and limited state fish and wildlife management activities, public access, and wildlife-related recreational opportunities; and lack of consideration of fish and wildlife resources as important wilderness resources that require active management (i.e., untrammeled by man, solitude and primitive recreation are set as priorities above fish and wildlife resources). This limited prioritization of values has led to the loss of access and degradation of fish and wildlife resources within some special designations areas.

State fish and wildlife agencies can appreciate the intent of certain special land designations and recognize the benefits that wilderness-like management philosophies may provide to a select group of citizens and recreationists. However, overly restrictive special land designations do not necessarily ensure the continued well-being of fish and wildlife populations nor eliminate the impacts that outside factors will have on fish and wildlife resources. Instead, these land designations can unnecessarily limit the land and resource agencies' abilities to address these impacts. In some cases, alternative management allocations (as compared with wilderness-like allocations) that direct the federal land management agencies to manage for the special characteristics in a particular area pursuant to multiple-use and sustained yield principles, could more effectively ensure the continued well-being of fish and wildlife populations. Wildlife management is often best served by a multiple-use policy.

However, when wilderness-like (i.e., very restrictive) special land designations take place, the negative consequences for the state fish and wildlife agencies can be minimized by involving the states early in planning processes associated with national policy and local planning efforts. Because of the states' responsibilities for the conservation of fish and wildlife populations, we request early and meaningful involvement during development of special land designation proposals and management plans. This level of coordination with the states is not constrained by the Federal Advisory Committee Act, and federal agencies should consider the use of small working groups of federal/state agency

staff for developing special land designation proposals and management plans. The Service's action to involve the state fish and wildlife agencies in the development of national wildlife refuge policies as a true statutory partner provides a model for the level of state/federal agency cooperation that some states' are seeking at the national level on legislation and policy related to special land designations. The "Policies and Guidelines for Fish and Wildlife Management in National Forest and Bureau of Land Management Wilderness" provides a model for national guidance that facilitates effective state/federal agency cooperation at the local level.

Fish and wildlife populations and their habitats are important components of federal public lands, including special designation areas, and some states believe that management can continue to fulfill specific fish and wildlife conservation purposes while also maintaining other special designation values and purposes. This cooperative approach and development of special land designation proposals and management plans would facilitate state/federal agency efforts that advance sound conservation of fish and wildlife resources on federal public land.

A Comparative Ecological Risk Assessment on Northern Spotted Owls and Fire

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Arguably, Rachel Carson's book, *Silent Spring* (1961), was instrumental in launching the American environmental movement. Passage of the National Environmental Policy Act of 1969 (NEPA) and establishment of the Council on Environmental Quality (CEQ) and Environmental Protection Agency (EPA) in 1970 can be attributed partially to the environmental awareness that Carson raised in her book. Soon after NEPA was established, several federal environmental regulatory laws were passed, including the Clean Air Act of 1970, the Clean Water Act of 1972 and the Endangered Species Act (ESA) of 1973; all traceable to the spirit of environmental awareness and concern raised by Rachel Carson.

Common to *Silent Spring* and the federal regulatory laws that followed were concerns for documenting and reducing environmental harm caused by anthropogenic development and management of natural resources. At the time, environmental regulations frequently focused on proposals for major actions (e.g., dam building) and the associated environmental impacts, adverse effects, and standards or alternatives to prevent or mitigate adverse effects. For federal land management agencies such as the USDA Forest Service or Bureau of Land Management, the process for conducting these environmental assessments was and continues to be influenced by NEPA and ESA.

NEPA requires consideration of a "no action alternative" for all proposed projects, though rigorous evaluations of this alternative are rarely conducted. Rather, the "no action alternative" is often assumed to result in the *status quo* and thereby not instill harm on protected species or the environment. Indeed, most regulatory attention in fire-prone forests of the West in the 1990s and early 2000s focused on preventing short-term adverse effects of management on ESA protected species. More recently, project emphasis on federal lands has shifted from timber production to hazardous fuels treatment, but little attention has been given to the short- or long-term consequences of inaction. Some contend that the detrimental effects of management or action are equal if not less than the detrimental effects of no management or inactions (Mealey and Thomas 2002, Mealey et al. 2005). In fire-prone forests of the West, it is well documented that inaction leads to a continued accumulation of fuels resulting in a landscape susceptible to uncharacteristic fire with corresponding negative effects on protected species habitats (Courtney et al. 2004, Lint 2005, Spies et al. 2006, Ager et al. 2007). The paradigm that significant environmental risks result only from committed acts rather than from their omission continues to plague regulatory implementation of federal resource plans and management activities.

Jack Ward Thomas, former Chief of the USDA Forest Service and former Boone and Crockett Endowed Professor at the University of Montana, commented on the problem of "dynamic versus static management" in fire-influenced landscapes at a 2002 conference in Bend, Oregon ("Fire in Oregon's Forests"). In reference to the area covered by the Forest Service's Northwest Forest Plan, Thomas noted that environmental laws from the 1970s that were intended to protect listed species and water quality were the predominant tools for furthering preservationist, overly precautionary strategies that resulted in static or "hands-off" management. He observed that federal court decisions routinely reinforced this concept of static management. Thomas concluded that static management was flawed because ecosystems are dynamic and change is constant. In fire-prone forests, unabated fuel accumulation leads to uncharacteristic wildfires that can ultimately harm listed species and water quality. Thomas viewed these long-term effects of management inaction as either ignored or downplayed in environmental assessments.

Mealey et al. (2005) noted that the highly restrictive precaution embedded in the short-term risk averse management standards and guidelines cited by Thomas has been a barrier to restoration management and achieving conservation goals in fire-prone landscapes. This calls into question the practice common throughout the West of attempting to maintain "static" unmanaged conservation reserves in dynamic fire-prone forests. Here, the *absence* of active management to mitigate fire risks may result in greater risk to the vulnerable species. Ironically, continuation of short-term risk averse protection measures without considering the likely effects of management inaction may lead to the continued deterioration of the very resources environmental laws were intended to protect.

In response to federal agency uncertainty about handling risk in ESA consultation, President Bush placed high priority in the Healthy Forests Initiative (Bush 2002) on "developing guidance for weighing the short-term risks against the long-term benefits of fuels treatment and restoration projects." Regulating agencies issued a policy that ESA Section 7 consultations should balance the "long term benefits of fuel treatment projects … against any short or long term adverse

effects" (Williams and Hogarth 2002). However, this policy has not been incorporated into the Endangered Species Consultation Handbook (U.S. Fish and Wildlife Service and National Marine Fisheries Service 1998) that, as national policy for consultation, is legally binding.

In deference to the possibility of harm from short-term risk averse protection measures, the Healthy Forests Restoration Act requires that judicial courts, in considering an injunction of an authorized project, balance the "impact to the ecosystem likely affected by the project, of the short and long term effects of undertaking the agency action, against the short and long term effects of not undertaking the agency action," (Healthy Forest Restoration Act of 2003: Sec 106, (c) (3)). Presumably, management agencies complete the required comparative ecological risk assessments in support of the court requirement.

The complexities of conducting comparative ecological risk assessments that predict ecological outcomes for different management strategies over relatively long time frames, at large spatial scales and for highly integrated systems, are daunting. Models often are used to structure complex systems and forecast possible outcomes. We developed a modeling framework for conducting comparative ecological risk assessment involving northern spotted owls (*Strix occidentalis caurina*) in fire-prone forests of southwestern Oregon (Roloff et. al. 2005a, 2005b). Our goal was to conduct a scientifically credible comparison, within the confines of our model assumptions, of long-term management and no management risks. Our objectives in this paper are 1) to review previous findings from Roloff et al. (2005a, 2005b); 2) describe how those findings influenced our current modeling approach; 3) present results from the current approach; and 4) place our current results in the context of resource planning and management as influenced by NEPA and ESA.

Method for Comparative Ecological Risk Assessment

The data, prescriptions and processes used to conduct our comparative ecological risk assessment have been described elsewhere (Roloff et al. 2005a, 2005b). These prior publications described model and data linkages, identified quantifiable risk metrics, revealed some basic ecological characteristics of our study landscape that warranted further scrutiny and offered preliminary insights into risks associated with three different management scenarios (no management, passive active management and active management) (Roloff et al. 2005a, 2005b). Here we present an abbreviated study area description, synopsis of the modeling process and a summary of model changes that are unique to the set of results presented in this manuscript.

Study Area

The Southwest Oregon Risk Demonstration Project Area (SORDPA) encompasses 830,000 acres (336,000 ha) of land approximately 6 miles (10 km) northeast of Medford, Oregon. The SORDPA is located at the southern edge of the Western Cascades ecoregion (McNab and Avers 1994). Elevations range from 980 to 7,200 feet (300 to 2,200 m) above sea level. The area receives 50 to 150 inches (127 to 381 cm) of precipitation per year (mostly during October to June) with average annual temperatures ranging from lows of 32 degrees to highs of 104 degrees Fahrenheit (0°C to 40°C) (McNab and Avers 1994). Fire is an important disturbance agent in the SORDPA, with the landscape dominated (59 percent) by mixed-fire regime plant association groups (PAGS) (*sensu* Atzet et al. 1996). Frequent-fire regime PAGS (19 percent of the landscape) occur on the lower to mid-elevations and evidence suggests that Native Americans frequently ignited these types to enhance forage production (South Cascades Late Successional Reserve Assessment 1998). Long fire-return interval PAGS (20 percent of the landscape) tend to occur at the higher elevations where lightning was and continues to be the primary fire ignition source (South Cascades Late Successional Reserve Assessment 1998). Fire suppression in the SORDPA started in 1902 and, coupled with timber harvest and lack of prescribed fire, has resulted in conditions suitable for large-scale, high-intensity wildfires (South Cascades Late Successional Reserve Assessment 1998).

Comparative Risk Model

Our risk assessment process integrates information about the ecological characteristics of the landscape, vegetation dynamics as related to different management scenarios, and fire potential modeling to generate inputs for effects analyses (Roloff et al. 2005a). All data and software used in our process were publically available. We initially developed an ecological land classification for our study that portrayed different vegetation states. A vegetation state was defined by existing vegetation conditions (derived from remote imagery) and site potential. The resulting classification defined more than 900 vegetation states that could potentially occur and be mapped in our study landscape; at any given model time period about 400 states would actually occur. To model the dynamics of these vegetation states, we used the Forest Service's West Cascades Variant of the Forest Vegetation Simulator (Keyser 2008). We compiled tree inventory plots ($n \approx 800$) to structurally describe different vegetation states, and these data were used by the simulator to implement prescriptions and project vegetation conditions into the future at five-year time intervals. The simulator produced an average tree (both live and dead) inventory for each time step and a corresponding vegetation state. As such, we relied on a state-transition model (Bestelmeyer et al. 2009, Fancy et al. 2009) to portray vegetation dynamics.

In our original work we relied on the Forest Service's strategic forest planning model (ForPlan) (Iverson and Alston 1986). Our early results using ForPlan clearly demonstrated that a more tactical approach (in space and time) to the allocation of fuel treatments was needed to reduce fire risk and minimize negative effects on spotted owls (Roloff et al. 2005b). In our third model generation, the results of which are presented in this manuscript, we allocated and implemented management prescriptions in ArcGIS 9.2 (Environmental Systems Research Institute, Redlands, California). The ArcGIS 9.2 allowed us to more tightly control the timing and spatial placement of prescriptions; an activity we found critical to a working solution from our model.

We characterized fire risk to spotted owls using the Forest Service's FlamMap model (Finney 2006). The FlamMap model requires data on weather and wind conditions, fuel characteristics for different vegetation states, and topography. Wind and weather conditions were based on 30 years of large-fire history data in Oregon (Roloff et al. 2005a). Fuel characteristics for the different vegetation states were derived from tree inventory data. We used the map of potential crown fire activity from FlamMap (Scott and Reinhardt 2001) to identify those portions of the study area susceptible to passive or active crown fire if ignited.

We evaluated risk to spotted owls by comparing potential crown fire activity to the location of modeled spotted owl territories. The spotted owl model was used to map nesting (Zabel et al. 2003) and foraging (Irwin et al. 2000) habitats and subsequently combine these habitats into home range cores (Roloff and Haufler 2001). Each home range core was buffered by 1.2 miles (1.9 km) to define the area around each core subjected to ESA restrictions on forest management activities.

Our comparative risk model compares the risks or benefits of management action to the risks or benefits of no management:

Management: (Total Provided) – (Total in High Risk) at time x
No Management: (Total Provided) – (Total in High Risk) at time x
Net Risk/Benefit of Action at time x

Total Provided refers to the total number of spotted owl territories located in our management area of interest (here defined as those containing greater than 50 percent frequent fire PAG). *High Risk* in our model is quantified as those spotted owl territories with abundant crown fire potential. Historically, environmental impact assessments focused on known short-term risks resulting from management and assumed that no management risks were benign (Mealey et al. 2005). We now know that this no management assumption is invalid in fire-prone landscapes (Mealey and Thomas 2002). Our modeling process provides a framework for more equitably evaluating these risks.

Current Risk Model Formulation

Previous findings influenced the structure of our current comparative risk model runs. We previously found that administrative (e.g., wilderness areas, late-successional reserves) and ownership designations for our study area were too prohibitive for implementing effective fuels reduction treatments (Roloff et al. 2005a). If we honored original land allocations that identified protected areas (e.g., wilderness, riparian zones, spotted owl habitat) and areas designated for timber production, less than 1 percent of the landscape was available for fuels reduction treatments (Roloff et al. 2005a). Simulation modeling suggests that fuels on greater than 20 percent of a landscape must be treated to effectively influence fire potential (Finney 2001). Our current model formulation focuses on reducing hazard across the areas of the landscape that contain frequent-fire PAGs, regardless of administrative or ownership designation. Thus, the entire frequent-fire PAG area (i.e., 19 percent of the landscape) was available for fuel reduction treatments, though in any given time period less than 10 percent was actually treated.

In previous model runs, we implemented a broad-scale spotted owl prescription designed to retain some habitat elements while reducing tree stem densities. This prescription resulted in higher long-term fire risk for the landscape (Roloff et al. 2005a). In our current model formulation, we focused our fuel reduction prescriptions only in those spotted owl territories that were in a high-risk condition. We also did not manage owl habitat with the objective of retaining habitat elements. Rather, we focused treatments on reducing fire risk, accepting the fact that some spotted owl core areas may be lost or displaced as a result of management.

In our current model formulation we focused fuel reduction activities on frequent-fire PAGs. Previously, we tried to manage the mixed-fire regime PAGS with limited success at reducing landscape-level fire risk (Roloff et al. 2005b). Our mixed-fire regime prescriptions were effective at the patch-level for older forest types, but a large component of fire risk in this landscape was associated with younger forest types that did not trigger a fuels reduction treatment in our model (Roloff et al. 2005b). Mixed- and frequent-fire PAGS in our landscape were inter-mixed, with the mixed-fire PAGS tending to occur on northerly and easterly topographic aspects, and frequent-fire PAGS on southerly and westerly aspects. Our spotted owl habitat maps suggested that lower elevation spotted owl cores were almost consistently associated with these mixed-fire PAGS. We hypothesized that we could treat the inter-mixed frequent-fire PAGS and thereby reduce the negative effects of management on these lower elevation spotted owl territories.

In our current model formulation we changed our philosophy on managing young plantations. In previous models this source of risk was seldom treated because the strategic planning model ForPlan, based on an objective function for maximizing net present value while simultaneously reducing fire risk, would not rank young plantations for treatment due to economics. We noted that young plantations are an important contributor to fire risk (Roloff et al. 2005b) in this landscape, though the temporal window of high risk is shorter compared with older forest types. Young plantations were available for treatment in our current model formulation.

Results

Vegetation states subjected to a no management regime followed an expected projection of risk. Young seral stages exhibited high fire risk. As younger forests matured into single-storied, closed canopied, taller types, the potential for canopy fire from a ground source ignition decreased. As these forests continued to mature they once again entered a high risk condition because they became multi-layered with abundant ground and ladder fuels. These risky, older forest vegetation conditions often are associated with spotted owl habitat, particularly at lower elevations in the fire-prone forests of the West (Courtney et al. 2004).

Vegetation states subjected to a management regime fell into two categories 1) the older, multi-layered stands with abundant ground and ladder fuels; and 2) young, dense plantations. Under a typical older tree management scenario, vegetation states initially would be treated based on a q-ratio prescription (Bailey and Covington 2002), with repeated entries every 30 years. A typical prescription in our model was to sustain 45 to 90 square feet per acre (10-20 m^2/ha) basal area with thinning based on a q-ratio of 1.15 over the entire size distribution, retaining fire tolerant species and excluding trees greater than 36 inches (91 cm) in diameter. The same q-ratio was applied to younger plantations but no residual basal area target was identified.

We portrayed fire risk to spotted owls for six time periods: 2003, 2008, 2018, 2038, 2058 and 2078. The number of spotted owl territories encompassing greater than 50 percent frequent-fire PAGs during this 75-year span ranged from 23 (Active Management, Year 2018) to 7 (Active Management, Year 2058). According to our model, these home ranges accounted for less than 18 percent of the total spotted owl territories in the landscape. The amount of area managed in any given time period ranged from 4,332 acres (1,754 ha) in year 2038 to 75,093 acres (30,402 ha) in 2058, or 1 percent and 9 percent of the landscape, respectively. This relatively wide range of managed acres was not unexpected, as one limitation of using state-transition models to portray vegetation dynamics is that all acres from different states simultaneously fulfill management criteria. Thus, in 2058, one of the more common vegetation states found on frequent-fire PAGS moved into a crown fire condition and, hence, all those acres were eligible for management. This result relates to assumptions associated with how state transition models work (Ravindran et al. 1987) and some have questioned their utility for portraying vegetation dynamics (Olson et al. 1985). State transition models are useful for strategically identifying broad categories of vegetation states that require management. Actual implementation of the model solution requires site-level decisions with harvests spread over multiple years.

We observed a temporal change in the vegetation states requiring management over our model horizon. Our model indicated that forests were prone to crown fire during the young, regeneration stage and during the older forest, understory re-initiation stage (*sensu* Oliver and Larson 1996). During both of these vegetation states, ladder fuels are abundant and fire is likely to reach tree canopies. In the early years of our model simulation, fuel reduction activities were primarily occurring in young, commercial forest plantations. By year 2058, the management emphasis shifted to older, multi-storied vegetation states. This scenario corresponds to land ownership patterns and associated landscape conditions at the start of our model simulation. It is not uncommon for lower elevation, frequent-fire areas of the West to occur at the interface of private and public ownership. In our landscape this was the case, with private ownership dominated (23 percent of the landscape) by commercial forest timberlands and public ownership dominated by federal lands managed for northern spotted owl protection. Thus, both private and federal management regimes created risky conditions in this landscape by mixing young plantations and older, multi-layered forest structure on PAGs that are susceptible to fire. Our results show that treatment of both vegetation states is important over the long-term to reduce the risk of crown fire in spotted owl habitat that occurs in these areas.

Based on our model simulation, active management resulted in a net benefit to northern spotted owl habitat in four of the six time periods evaluated (Figure 1). The risk to spotted owls varied depending on simulation year (Figure 1). During most simulation years (five out of six) the total number of owl territories occurring on frequent-fire PAGS was higher under the no management scenario (Figure 1). However, no management resulted in high risk territories in some years (defined as those territories with greater than 50 percent potential for crown fire), thereby making active management a better alternative in years 2003, 2038 and 2058 (Figure 1). Additionally, the active management scenario provided a net of four owl territories in 2018. In regard to NEPA and ESA analyses and project planning and review, our model indicates active management is less risky than no (passive) management for spotted owls in most simulation years.

Decision makers are challenged with deciding on how much risk they are willing to accept and over what time frames. Early in our model simulation (i.e., year 2003) management benefitted spotted owls (+2) because high-risk plantations that occurred in spotted owl territories were thinned. Management also benefitted spotted owls in 2018, 2038 and 2058 (Figure 1). The 2038 results correspond to the time period when mature forest types that were treated in 2003 were re-entered for maintenance thinning, i.e., our fuel treatment prescription required a 30-year re-entry. The landscape from 2038 to 2058 became very risky under the no management scenario, with a majority (80 percent) of the territories in a high-risk condition by 2058 (Figure 1). This risk abated in 2078 (Figure 1), though high risk conditions were forming (i.e., 100 percent of the risk abated in 2078, although high-risk conditions were forming (i.e., 100 percent of the territories had a greater than 40 percent potential for crown fire) (Table 1) in those owl territories. Our results demonstrate the importance of considering multiple time periods during long time frames when conducting risk assessments. The level of risk changes through landscapes over time and thus, it is erroneous to assign a single risk value to a long time period. Decision makers should consider the entire risk profile (e.g., Figure 1) and decide whether to subject protected species to periods of potential volatility in the landscape (e.g., high-risk conditions under no management) (Figure 1) or to subject those species to management activities that apparently result in less volatile conditions. Our results confirm that the impacts resulting from short-term decisions manifest themselves over long time periods with potentially profound consequences on protected species conservation.

Figure 1. Count of northern spotted owl territories containing greater than 50 percent frequent fire plant association group (PAG) by management regime and simulation year. High risk is defined as those owl territories with greater than 50 percent potential crown fire. Numbers above the active management bar correspond to output from the comparative risk equation.

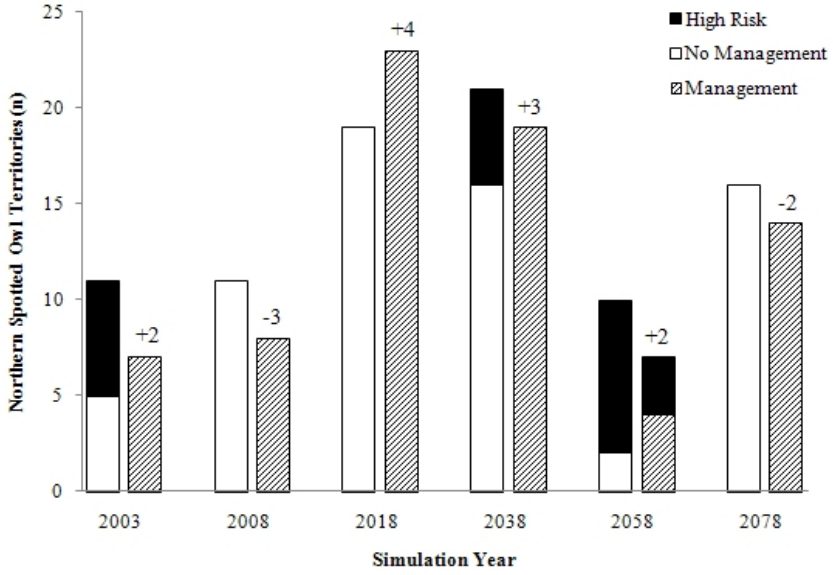

Table 1. Number of spotted owl territories containing greater than 50 percent frequent fire PAG (total) by management scenario in a high-risk category according to different crown fire risk thresholds. The crown fire risk threshold is expressed as the percentage of the total owl territory with crown fire potential if ignited.

	No Management Territories				Active Management Territories				Net Risk (-) or Benefit (+) of Active Management		
	Crown Fire Risk Threshold				Crown Fire Risk Threshold						
Year	Total	>30%	>40%	>50%	Total	>30%	>40%	>50%	>30%	>40%	>50%
2003	11	11	9	6	7	2	2	0	+5	+3	+2
2008	11	0	0	0	8	6	3	0	-9	-6	-3
2018	19	0	0	0	23	2	0	0	+2	+4	+4
2038	21	17	12	5	19	0	0	0	+15	+10	+3
2058	10	10	10	8	7	6	4	3	+1	+3	+2
2078	16	10	5	0	14	2	0	0	-4	+3	-2

Discussion

Models are limited in their ability to accurately forecast events, particularly over long time intervals. We acknowledge that our modeling process contains considerable uncertainty and untested assumptions though we purposefully based our framework on published science and well-documented tools. Some have questioned the use of predictive models for natural resource planning and management (reviewed by Starfield 1997), however, modeling is often the only alternative for informing decision makers (Roloff et al. 2001). Decision makers must, at a minimum, consider model outputs when formulating long-term resource management strategies. Our process for modeling fire risk to spotted owls compared no management and active management alternatives. The modeling process produced outputs that incorporated short- and long-term risk in terms that could be easily described, mapped on the ground and validated through an adaptive management framework. We encourage public agencies that operate under NEPA and ESA to conduct similar assessments when evaluating planning and project alternatives. The tools, data and framework are generally available to conduct coarse comparative risk assessments like the one described here.

Fire risk to protected species fluctuates, with these fluctuations caused by changes in fuel structure as vegetation regenerates and matures. We found that tactical placement of fuel treatments can be a preferable alternative for spotted owl conservation in fire-prone landscapes. Whether benefits from active management are realized depends on the abundance, placement, and persistence of hazardous vegetation states and how risk is defined. In our modeling process decision makers must: 1) define high risk (i.e., how much fire risk in an owl territory is acceptable; see Table 1); 2) decide how to treat high risk while minimizing impacts to the protected resources; and 3) identify the time frames for risk quantification. We recommend that risk profiles (e.g., Figure 1) include a risk calculation at least every 20 years and be long enough to include at least one forest successional cycle.

In response to federal mandates that require evaluation of a no management alternative in resource planning and management assessments, we developed and conducted the comparative risk assessment described herein. Numerically, the net benefit of management to spotted owls during some time periods (from two to four territories depending on time period; Figure 1) seems small. However, we caution that the total number of spotted owl territories occurring on areas dominated by frequent-fire PAGs is also small. As such, small numerical benefits actually correspond to a substantial proportion of the population occurring in these risky environments. For example, in 2003 no management resulted in high-risk conditions for 55 percent of the potential owl territories. The benefit of active management in 2003 constitutes conserving 18 percent more owl territories than the no management alternative.

Outcomes from our process were strongly influenced by our definition of high risk. We assumed that spotted owl territories were at high risk from uncharacteristic wildfire when greater than 50 percent of their territories were in a vegetation condition conducive to crown fire. Results in Figure 1 portray our outcomes under this assumption. Our definition of high risk may be overly conservative in light of recent publications noting increased vulnerability of western forests to uncharacteristic fire because of an increasingly warm and dry climate (Allen et al. 2010, Liu et al. 2010). Our comparative risk process permits evaluation of alternative risk definitions that might be more appropriate under changing climate conditions. Under a lower high-risk threshold (i.e., 40 percent of an owl territory in crown fire potential) the case for active management becomes even more compelling, particularly during risky time periods (e.g., 2038) (Table 1).

Conclusion

At the conclusion of any modeling exercise one should conduct a critical assessment of usefulness, practicality and feasibility. We contend that our model results provide useful information to decision makers currently involved with the fire-prone landscapes of southern Oregon. These results indicate that active management was a preferable alternative to no management for spotted owl conservation in the majority of years we evaluated with the greater than 50 percent crown fire risk threshold. Active management appears even more preferable using a lower risk threshold (e.g., greater than 40 percent) (Table 1). We also contend that our risk assessment framework provides a useful tool for decision makers that are balancing protected species conservation in other risky landscapes. Regardless of the protected resource value, whether it is spotted owls, salmon, water quality or forest health, risk metrics can be calculated from this framework (Roloff et al. 2005a). Decision makers are tasked with identifying potential conflicts between protected resource conservation and the large-scale factors most likely to place those resources at risk. Once those components are identified, a comparative risk assessment framework like that presented here and described in more detail elsewhere (Roloff et al. 2005a) should be conducted.

The risk assessment process was practical and feasible when viewed in the context of typical NEPA assessments. The process was practical in that it was built and implemented with publically available data, tools and software. The process required some sophisticated data management, software programming and geographic information system work and, thus, individuals with certain expertise are needed potentially hindering feasibility. However, this level of expertise is

common in public lands strategic planning and, as such, we believe that most public agencies that conduct spatially explicit, long-term strategic planning can implement the risk assessment process.

The true test of a comparative risk assessment depends on its ability to withstand external scrutiny by the scientific community, environmental organizations and ultimately, in many cases, the judicial system. Admittedly, processes like the one described here have not undergone rigorous external evaluation. With current federal land management policies requiring comparative risk assessments, we believe that a robust evaluation is forthcoming. We offer our framework as one approach that appears to warrant consideration. Careful attention to the comparative effects of active and passive management as portrayed in this case study could modify overly precautionary, short-term risk averse policies and lead to active management designed for reducing long-term fire risk and conserving protected species habitats as intended by the ESA.

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Special Session Three.
The Power of Partnerships in Bird Conservation: North America and Beyond

The Power of Partnerships in Bird Conservation: The Creation and Evolution of Partners in Flight

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I (TDR) remember very clearly when I first learned about the power of partnerships. I had decided to attend the first meeting of the North Dakota Action Group, the state-based waterfowl and wetlands working group formed after the North American Waterfowl Management Plan was signed. I had worked for the U.S. Bureau of Land Management from 1980 to 1985 in Idaho and was used to working with ranchers, the Idaho Fish and Game, Pheasants Forever, and a few other entities. So, I thought I knew something about partnering.

When the Action Group began introducing themselves at that big table in Bismarck in 1987, I suddenly got a picture that has stayed with me ever since. Sure, there were a dozen refuges, the North Dakota Game and Fish Department and several conservation NGOs. That was a typical turnout from the robust conservation community in North Dakota. What changed my concept of partnerships forever were the bankers, irrigators, realtors, Chambers of Commerce, division of tourism, highway department, newspaper, grazing association, national park, privates landowners and more. Before the introductions were even finished, I thought, "Wow, this is how you do it."

Roots of Partners in Flight

Partners in Flight (PIF) was created in 1990 (National Fish and Wildlife Foundation 1990) to protect and restore populations of migratory birds that were experiencing pronounced population declines, particularly a group of species that bred in the northeastern United States and southeastern Canada (Robbins et al. 1986). The roots of PIF can probably be traced back in time as far as you care to look. But if we have to draw a line somewhere, we'll say PIF began at the April 1966 symposium–The Avifauna of Northern Latin America – held at the Smithsonian Institution. There were 41 attendees, mostly world-renowned ornithologists and ecologists, and 14 papers were presented (Buechner and Buechner 1970).

Although the title of the symposium and the titles of many papers might not reveal the origins of PIF, the content surely does. S. Dillon Ripley, Secretary of the Smithsonian Institution, says in his preface to the proceedings, "Controlling factors on the winter ranges, about which we have little knowledge at the present time, may be as important, if not more so, in inhibiting the population growth of these species of birds as any of the factors known to us on the summer ranges, such as the destruction of initial habitats, vast changes in secondary habitats, and intensive spraying of insecticides. Our concerns with migratory species on their north temperate ranges perhaps tend to cloud the total issue because, obviously, the birds spend a good part of their time in habitats alien to us about which we know relatively little from a biological point of view. The results of this conference help us to envision the changes occurring in Latin American habitats and to prepare our thoughts and considerations for the future" (Ripley 1970:1).

Hopefully, Ripley would have been pleased to know that the most recent conference on this subject–the 4th International Partners in Flight Conference in McAllen, Texas, in February 2008–attracted nearly 700 people (an increase of 17 times) and that there were about 500 oral and poster presentations (an increase of 35 times, Rich et al. 2009). Yet, we hasten to add that the Secretary might also be a bit dismayed to know that we have still not precisely identified "…. controlling factors on the winter ranges …." or controlling factors elsewhere.

Our understanding of threats to bird populations and our ability to quantify them has increased dramatically since that 1966 symposium, but we have many of the same problems. For example, the organizer of the symposium, William Vogt, observed that, "Many bird watchers have noted an apparent shrinkage in numbers of a variety of more familiar species …" (Vogt 1970: 8). This observation preceded John Terborgh's (1989) *Where Have All the Birds Gone?* by 23

years and the National Audubon Society's "Common Birds in Decline" report (http://www.audubon.org/bird/stateofthebirds/cbid/index.php) by 41 years. Of course, both Terborgh and Audubon conducted extensive analyses on data that didn't exist when Vogt first noticed these declines. The Vogt-Terborgh-Audubon vector reveals that our progress in conservation, and perhaps in society at large, is typically incremental, not saltatorial. It often takes a long time to institutionalize small improvements in our knowledge and in our actions.

In that same volume, Marston Bates wrote, "Everywhere we have the processes of urbanization and industrialization and the overwhelming problem of rapid population growth with its pressures on the world around us" (Bates 1970: 7). We're tempted to put this quotation as the concluding sentence in this article because human population growth is the ultimate problem for wildlife conservation but it is never faced squarely by wildlife professionals.

The main reason that Terborgh and the National Audubon Society could enrich Vogt's concept with actual data emerged in a paper that provided the foundation to everything we know about landbird populations. Aldrich and Robbins (1970) wrote, "We feel certain that great changes in abundance of birds have taken place in the past as a result of environmental changes, but until recently we have had very little documentary evidence of the magnitude of these changes." And as a result, "The Bureau of Sport Fisheries and Wildlife is presently embarking on an extensive program to detect and measure changes in abundance of almost all species of North American birds. This **breeding bird survey** was tested in the states of Maryland and Delaware in the summer of 1965 …" (Aldrich and Robbins 1970, emphasis added).

Chan Robbins is a tangible link to this historical symposium, and we're happy that he has seen the nearly unfathomable dividends that the Breeding Bird Survey (BBS) data are paying to this day. BBS is the foundation for the PIF Species Assessment Process (Panjabi et al. 2005) and a critical component of the USFWS Birds of Conservation Concern (http://www.fws.gov/migratorybirds/NewReportsPublications/SpecialTopics/BCC2008/BCC2008.pdf) list, the annual State of the Birds reports (North American Bird Conservation Initiative, U.S. Committee 2009, 2010) and countless publications in the primary ornithological literature.

In that same symposium, Holdridge (1970: 30) concluded with an idea that PIF has only recently embraced fully, "Somehow all people must be induced, even if through indirect channels at present, to maintain a significant portion of their rich natural heritage for future generations to know at first hand and to enjoy. To do this we have to do more than continue to say some nice words for conservation or create parks on paper." The Bird Education Alliance for Conservation and Bird Education Network are now working strategically to reach the many different audiences in North American societies. The State of the Birds reports (e.g., North American Bird Conservation Initiative, U.S. Committee 2009, 2010) and Berlanga et al. (2010), are targeted at the broader public rather than at just scientists.

This founding volume (Buechner and Buechner 1970) concluded with recommendations for natural areas, legislation, research, education, communication and management. Many of these recommendations are very familiar, having been repeated in one form or another in every bird conservation plan, strategy document and needs assessment since that time.

However, the two areas where we see a substantially increased emphasis by PIF today, as compared with 1966, are funding and population monitoring. And related to the latter, the pre-PC world of 1966 was not overly concerned with data management. Today, we are happy to have this problem and a whole new suite of experts dedicated to getting the most useful information out of all the resources we invest in bird monitoring.

While ornithologists interested in neotropical migrants were honing their research and increasing their numbers, a group of colleagues were preparing to take the idea of partnerships for bird conservation to a new level. The North American Waterfowl Management Plan in 1986 and the North American Wetlands Conservation Act in 1989 are rightly celebrated as paradigm shifting. Every bird conservation initiative that followed, and indeed initiatives for other taxa, modeled themselves on the North American Waterfowl Management Plan. This fundamental soundness of purpose, strategy and practice led Gary Myers, then of the Tennessee Wildlife Resources Agency, to exclaim, "Birds are just like ducks!"

The next milestone occurred at Manomet Bird Observatory (now Manomet Center for Conservation Sciences) in a symposium on the Ecology and Conservation of Neotropical Migrant Landbirds held in December 1989, the same year Terborgh's book *Where Have All the Birds Gone?* came out. This symposium (Hagan and Johnston 1992) had 65 papers and posters, and 300 attendees. But what is most notable is the degree to which ornithologists, many of whom are still active today, had conducted research on the species and issues raised at the Smithsonian in 1966.

What strikes us, in addition to all the new research findings, were the remarks in the preface by then U.S. Congressman Gerry E. Studds (Hagan and Johnston 1992: vii), remarks that would resonate today with anyone, if we could make them aware, "…. these species have an almost mystical power to captivate the human imagination. These small brightly colored creatures full of song, and only a few grams in weight, are able to make annual trips of unimaginable complexity and rigor, only to return each year, often to the same tree or bush. How do they do it? It is a sad fact that we are systematically destroying these homes to which they return. We are slow to realize that it is our home as well."

Along with these public displays of science and conservation dialogue, a number of people were working off the radar screen to do something about the population declines that were being researched, analyzed and understood in ever more detail. Many of these people did not publish papers but rather were working in government agencies and nongovernmental organizations to increase funding and improve policy–slugging out the unglamorous work that is essential if we are to change society.

Creation of Partners in Flight

As a result, and to simplify matters greatly, the National Fish and Wildlife Foundation (NFWF) created Partners in Flight in 1990. Amos Eno was Executive Director of NFWF at that time, and he hired Peter Stangel to take the lead on a new initiative for bird conservation. The original title of the initiative was the Neotropical Migratory Bird Conservation Program. Partner logos appearing on the historical 1990 "White Document" from National Fish and Wildlife Foundation (1990) were the USDA Forest Service, U.S. Fish and Wildlife Service, National Park Service and Bureau of Land Management. Clearly, NFWF believed that it would take major financial and political support from federal agencies to get this initiative off the ground.

The goals of the Neotropical Migratory Bird Conservation Program were laid out in five categories: Management, Research, Education, Outreach and Communication, Population and Habitat Monitoring, and International Partnerships. As pointed out above, the increased emphasis on monitoring was clear between the symposia of 1966 and 1989.The explicit new category was "International Partnerships." According to National Fish and Wildlife Foundation (1990: 6), "The development of the Neotropical Migratory Bird Conservation Program will catalyze previously unrealized partnerships among governmental and private conservation concerns in North America, Mexico, Central America, the Caribbean Basin, and South America."

The Internet and e-mail were just getting started at that time, and those tools would soon take international communication to a level simply unimagined. You cannot create and operate a partnership such as El Grupo Ceruleo–linking multiple partners in the US, Canada, Peru, Ecuador and Colombia–by licking stamps. Today, we communicate with hundreds of partners around the world, almost instantly, from a smart phone, while birding.

The first display of the breadth of the partnership that was becoming PIF occurred at the first organizational meeting in Atlanta, Georgia, in December 1990. More than 150 resource professionals representing over 100 partners, including representatives from Canada and Mexico, gathered to determine how PIF would be organized and to put more detail to its goals and objectives. Technical Working Groups were established for Monitoring, Research, Legislative, Information and Education, and International goals. While the names and objectives of the working groups have either changed over time or have been picked up by other entities, e.g., the North American Bird Conservation Initiative, much of the core work remains the same 20 years later.

The group that met in Atlanta also established regional working groups–Western, Northeast, Midwest and Southeast. These groups continue to this day, although they, too, have evolved over time. Some of the work that used to be the responsibility of these groups has now been picked up by state bird conservation initiatives, Joint Ventures, Flyway Nongame Technical Committees and other regional structures.

The name "Partners in Flight" and the logo were adopted shortly after this meeting. A critical result was that both the U.S. Fish and Wildlife Service and USDA Forest Service hired full-time coordinators for their programs. Further, the Fish and Wildlife Service also hired a "Nongame Migratory Bird Coordinator" in each of its seven field regions between 1991 and 1992. The U.S. Bureau of Land Management also responded quickly, hiring not only a full-time PIF coordinator, but also coordinators for their Upland Game Birds program and for their Waterfowl and Wetlands program.

NFWF began producing the PIF newsletter in the fall of 1991 with Volume 1 Number 1. Even this very first issue was jammed with substance–news on conservation programs, state agencies, monitoring, research citations, and a list of 33 bird conservation projects that NFWF had funded in the first round of their new grants program. The newsletter grew from the first issue's 16 pages to become so big and popular that only a few years later it had to be discontinued due to the cost of printing and mailing all the information that was coming into the rapidly expanding partnership. Electronic distribution was not yet a common practice.

Defining the Taxonomic Scope and Expanding the Knowledge

One of the first practical considerations for PIF was to determine which species the partnership would address. "Neotropical migrants" was a good conceptual category but, with so many scientists involved, this had to be defined more precisely. A list of 254 species in four categories, grouped not by vulnerability but rather by type of migratory behavior, was published in the winter 1992 issue of the PIF Newsletter. Of more interest than these categories was the taxonomic nature of the lists. Most species were "landbirds" as we understand them today, but also included were mountain plover

(*Charadrius montanus*), killdeer (*C. vociferus*), upland sandpiper (*Bartramia longicauda*) and long-billed curlew (*Numenius americanus*), honorary landbirds from the outset. No other shorebirds, waterbirds or waterfowl were to be seen. The taxonomic scope of PIF was not strictly defined until 14 years later (Rich et al. 2004).

The 1st Partners in Flight conference was held in 1992 at Estes Park, Colorado (Finch and Stangel 1993). Among the process meetings, workshops, multiple scientific sessions and creation of many new friendships was the first formal presentation of the PIF Species Prioritization Scheme (Hunter et al. 1993). This paper revealed the system by which the future vulnerability of hundreds of species could be assessed systematically according to a process that was partly an objective process and partly the systematic and rule-based quantification of expert opinion. The beauty of this approach was that significant progress could be made by harnessing information that was not strictly quantitative.

Selected papers from the proceedings were refined and rewritten for a book (Martin and Finch 1995) that provided both syntheses and reviews of various issues. Some of those chapters have yet to be improved upon. Other books quickly appeared that compiled natural history and ecological components of Neotropical migrants, providing important references (Rappole et al. 1993, DeGraaf and Rappole 1995, Rappole 1995, Paynter 1995).

It may surprise some to realize that Mexico has been part of PIF from the beginning. Mexican ornithologists participated in the 1966 symposium at the Smithsonian. And in 1993, less than a year after the first PIF conference, the first international symposium devoted specifically to the conservation of Neotropical migrant landbirds in Mexico was held in Los Tuxtlas, Veracruz. The foreword to the proceedings (Wilson and Sader 1995) was penned by an increasingly familiar face in the creation and evolution of this initiative, Chandler S. Robbins. Robbins wrote (Wilson and Sader 1995: v), "… the continuing loss of native habitats is posing an even greater threat to the resident tropical species and to the short-distance altitudinal migrants that spend their entire lives in Mexico than to most of the long-distance migrants." As usual, Chan was ahead of the game. The species vulnerability assessment completed for North America (Berlanga et al. 2010) has confirmed this statement. Indeed, Mexican resident species dominate the group of highest conservation concern.

Also in 1993, the Smithsonian Migratory Bird Center created the flagship outreach program for PIF, International Migratory Bird Day (IMBD), which occurred on May 8 that year. The first IMBD poster was a supremely colorful collage of birds by Kendall Jan Jubb, featuring a painted bunting (*Passerina ciris)* in the center. This species was on center stage again, being the sole species on the cover of the 2004 PIF plan (Rich et al. 2004). Jubb created posters for IMBD in 1994 and 1995, while a variety of artists have contributed since that time.

The Association of Fish and Wildlife Agencies–Mega Partner

Analysts have written that the five-year point is a critical one in the life of any new idea, whether it be an initiative, a magazine, a business or similar enterprise. If you make it past that point, you may then persist for some time. Two critical and related events occurred in the fifth year of Partners in Flight.

In October 1995, the 2nd international Partners in Flight Workshop was held in Cape May, New Jersey. More than 700 people attended. The workshop was entitled, "Strategies for Bird Conservation: The Partners in Flight Planning Process." The objective of this conference was, "to devise a mechanism for developing regional bird conservation plans, and an overall national plan, by coordinating the actions and desires of all geographical and technical working groups."

The second critical event, and likely the second most important event in the history of PIF (the first being its birth), was the awarding of a three-year, multi-state grant from the International Association of Fish and Wildlife Agencies (now the Association of Fish and Wildlife Agencies, AFWA). This grant funded four, full-time staff to coordinate the planning process in each of the PIF regions. A new bird conservation organization, the American Bird Conservancy, agreed to support the first-ever PIF national coordinator to supervise the regional coordinators and take the lead in guiding the entire process. To put it simply, this was huge.

In looking at the proceedings of the Cape May conference (Bonney et al. 2000), one can readily see the roots of conservation design, strategic habitat conservation, coordinated bird monitoring, setting measurable habitat and population objectives, and other aspects of large-scale, multi-species conservation that remain at the forefront of bird conservation today.

The geographic units for the PIF planning process (Pashley et al. 2000: 8) were derived from the Breeding Bird Survey's physiographic strata (Robbins et al. 1986), which were in turn based on earlier classifications of the vegetation of the United States. The original idea was that it was best to conduct biological planning along ecological boundaries, but this simple notion lead to one of the first rifts in PIF. The Western Working Group insisted that because implementation of conservation would occur along political, not ecological, boundaries, that the planning also should be done by the former. Thus, regional Bird Conservation Plans were written for states in the western United States and by ecological region in the rest of the country.

An Open Partnership

This difference among the regions on what boundaries to use illustrates a basic operating principle of PIF that perhaps had not quite come into focus until that time. That is, PIF would attempt to get everybody in agreement on a given issue. If consensus could not be reached, PIF would rather do a few different things, keeping the major goals of PIF in view, than become bitter, conflictive, controlling or disappointed. PIF embraced a couple of old saws at that point: 1) there are many ways to skin a cat, and 2) watch the donut, not the hole.

These operating principles fit nicely with some of the others that had been developed, not through focus groups, strategic planning or team-building workshops, but rather through common sense. It's one reason that it is almost impossible to actually list the number of partners who have contributed to PIF. All meetings are open to all people. If you are interested in a topic, you are welcome to contribute. If you are interested in a topic, you are on the committee. If you would like to lead the committee, you are the chair. If you would like to go away for 10 years and then come back, we welcome you back. If you can contribute a lot, we appreciate it. If you can only contribute a little, we appreciate that. PIF is a great example of, "the world is run by those who show up." PIF will not write nasty letters, throw stones or protest. That's the job of our partners. PIF will be happy to provide scientific information that bears on a topic. And, oh yeah, watch the donut, not the hole.

In the end, the PIF regional coordinators were funded for seven consecutive years through AFWA to write the regional Bird Conservation Plans and a national plan. The ability to focus five skilled ornithologists on assessment and planning took PIF over the five-year hump and onto the next level. The Bird Conservation Plans themselves had tremendous value as plans, but their life spans varied greatly. Some plans in the Midwest were never quite finished, some evolved into state Bird Conservation Initiatives, e.g., in Wisconsin, and others live on. As of this date, Nevada is updating its plan with new data and new discussions.

The Taxonomic Scope Expands and Splits

As the planning got underway following the Cape May conference, partners quickly realized that it made little sense to address only the original focal group of species–Nearctic-Neotropical migratory birds. All of the habitats of interest also contained short-distance migrants, residents, and species that breed farther north and then winter in the habitat of interest. Further, the taxonomic scope needed to be broadened to include the waterbirds and shorebirds that occurred in one season or another.

PIF was using its Species Prioritization Scheme (now the Species Assessment Process, Panjabi et al. 2005) to lay the foundation for setting species and habitat priorities at both regional and national scales. An early result of this product was publication of WatchList 1996 (Carter et al. 1996), which included 90 species, including shorebirds and waterbirds per the expanded species scope taken on at the outset of planning.

The national plan identified as a product out of the Cape May conference was completed in 2000 (Pashley et al. 2000). This document contained a summary of the priority bird populations, priority habitats, conservation issues and recommendations by physiographic area (as described above). The national plan also contained an update to the PIF Watch List of 123 species which included not only landbirds, shorebirds and waterbirds, but also waterfowl.

Only a few years later, the shorebird and waterbird experts decided that there were enough partners and unique issues surrounding each of these two groups of birds that they each justified their own initiative. These new initiatives culminated in the publication of their own major plans–the U.S. Shorebird Conservation Plan (Brown et al. 2001) and Waterbird Conservation for the Americas (Kushlan et al. 2002).

In the mean time, the Division of Migratory Bird Management of the U.S. Fish and Wildlife Service established new full-time positions for individuals to coordinate PIF, the shorebird initiative and the waterbird initiative. This was another critical step in the evolution of bird conservation in the United States because coordination was an essential job, given the urgent conservation needs, huge array of activities and number of partners involved. Coordinators for all three initiatives were hired in 2001.

The Emergence of the North American Bird Conservation Initiative

The splitting of shorebirds and waterbirds from PIF had some obvious benefits but also ended up having some costs. The benefit was that specialists could focus on those species and issues of most interest to them. The costs were several. First, often the same experts were involved in what had become four initiatives. So, all the meetings, communications, conferences and other activities competed for limited time. Second, there was a loss of efficiency in that all four initiatives were dealing with landscapes and habitats that were overlapping. Third, and perhaps even more importantly, the initiatives were now competing with each other, at least on occasion, for funding and political support.

And fourth, an issue which is not resolved to this day, was that neither the shorebird nor the waterbird initiatives adopted the PIF Species Assessment Process as it was. Each tweaked the process for its own reasons. And because the waterfowl community never did use the process, the bird conservation world was now faced with four sets of species priorities that could not be cross-walked directly with each other. The initiatives faced this squarely by forming the Multi-Species Assessment Committee. However, after several frustrating meetings no agreement was reached and the issue was tabled.

The attempt to create a unified species assessment process was only one component of a bigger idea that the proliferation of bird conservation initiatives, while wonderful in many ways, was also generating some problems. This situation led to the creation of the North American Bird Conservation Initiative (NABCI), whose vision was, in part, "… to facilitate the conservation of all native North American birds by increasing the effectiveness of programs and initiatives …." (North American Commission for Environmental Cooperation 1999). Roughly parallel structures were created in Canada, the United States and Mexico. Initial funding and other support came from the North American Commission for Environmental Cooperation.

Undoubtedly the most conspicuous result of NABCI was spawned during its first meeting in Puebla, Mexico in November 1998. That is where the "Implementation Group" envisioned "all of North America divided into Bird Conservation Areas; borders among BCAs should be based on ecological phenomena for planning, as influenced by social and practical issues for administration and delivery." These units became known as Bird Conservation Regions (http://www.nabci-us.org/bcrs.html) and have since become a standard base map for bird conservation activities (e.g., Rich et al. 2004, Dunn et al. 2005, http://www.pljv.org/cms/planning).

Asilomar

All of the new coordination among bird initiatives, NABCI, the Joint Ventures and other partners was put on stage at the 3rd International Partners in Flight Conference, held at the Asilomar Conference Center, Asilomar, California, March 20 to 24, 2002. The theme of the conference was Bird Conservation Implementation and Integration in the Americas (Ralph and Rich 2005), and more than 600 attendees from across the Western Hemisphere participated.

One paper at Asilomar deserves a little extra attention--Setting numerical population objectives for priority landbird species (Rosenberg and Blancher 2005). In this paper, the authors set out the methodology they used to estimate the total population size for landbird species. This paper started the conversation not only about how many individuals of a given species there are, but how many we want, where we want them, and by when. It launched a new era of quantified objectives and began the demise of words like "increase," "enhance," "improve" and other qualitative objectives that could never be measured and, thus, neither reached nor not reached.

The North American Landbird Conservation Plan

This method was revised and refined to produce estimates that were first published for all landbirds in 2004 (Rich et al. 2004). There were a variety of criticisms of the methodology, and a peer-reviewed critique with recommendations for improving the process was published by Thogmartin et al. (2006). But many of the critics missed the point. Rosenberg and Blancher (2005) were not suggesting that their estimates were the answers, they were just trying to get the conversation about population sizes and objectives started. This topic became so substantial that three national workshops were subsequently held to work out the details.

The North American Landbird Conservation Plan (Rich et al. 2004) was by far the most sophisticated planning document that PIF had produced to date. The Species Assessment Process had been refined since its inception in the early 1990s, and the species scores had undergone a decade of discussion and review. Thus, the 2004 Watch List of 100 species was particularly sound. Other innovations in the "Continental Plan" were species population estimates (see above), a monitoring needs assessment, population objectives, and a suite of new maps showing the occurrence of various groups of species during the breeding and non-breeding seasons.

With the end of the seven-year period of PIF Regional Coordinators in 2002, the paid staff in PIF went from five to one, with only the PIF National Coordinator remaining. There was some concern about the future of the initiative, but analysis and planning for the "Continental Plan" was underway (Rich et al. 2004), and regional species assessment workshops were starting in Mexico (see below).

Another important development was that conversations with the waterfowl Joint Ventures (JVs) were increasing. It soon became evident that the regional component of landbird conservation could and should now be taken over by the JVs. Thus, PIF assumed more of a support role for JVs, a role that is still being fleshed out as of this date. Interaction with JVs was enhanced by good working relationships among colleagues and by the hiring of former landbird specialists as JV

science coordinators and even JV coordinators. This evolution of the structure of the bird conservation community in North America has been both natural and progressive.

Improving the Human Dimensions of Bird Conservation

Partners in Flight holds its international conferences only when they are needed. By 2006, just four years after Asilomar, there was an undeniable sense that it was time to get together again. Planning was initiated for what would turn out to be a February 2008 conference in McAllen, Texas, entitled, "Tundra to Tropics: Connecting Birds, Habitats and People" (Rich et al. 2009). This was the first time the theme for International Migratory Bird Day and the theme for a PIF conference were the same.

Two other aspects distinguished the McAllen conference. First, the organizers wanted to conduct a conservation needs assessment. So each chair and participants in each session were charged to come up with a list of short-term and long-term needs in five categories–research, education, communication and outreach, inventory/monitoring, capacity building, and public policy. The results were published with the needs organized by session for 25 of the conference sessions (Rich et al. 2008).

Second, a strong push was made to include presentations on education, outreach and communication within each of the technical sessions. Almost exactly a year earlier, in February 2007 in Austin, Texas, A National Gathering for Bird Education was held by the Council for Environmental Education. This brought together, for the first time, a wide variety of ornithologists and educators to help synergize bird conservation education. The McAllen PIF conference was perfectly timed to build momentum on this idea. As a result, 8 conference sessions and at least 64 oral papers were devoted to education, outreach and communication. In addition to the individual session needs assessments (Rich et al. 2008), a synthesis of needs in this arena was also compiled (Dayer et al. 2009).

The Neotropical Migratory Bird Conservation Act–Partners Without End

The Neotropical Migratory Bird Conservation Act (NMBCA), passed in 2000 and first funded in 2002, has become the single most important source of grant funding for PIF as well as for the shorebird and waterbird initiatives. The NMBCA established a competitive, matching grants program that supports public/private partnerships carrying out projects in the United States, Canada, Latin America and the Caribbean that promote the long-term conservation of Neotropical migratory birds and their habitats. At least 75 percent of the total funding available for grants each fiscal year is to be used to support projects outside the U.S.

The NMBCA has been a spectacular success, with requests greatly exceeding the annual authorization of $4 to $5 million. Between 2002 and 2008, the program supported 260 projects, coordinated by partners in 48 states/territories and 36 countries. More than $25.5 million from NMBCA grants have leveraged about $116.5 million in matching funds and $6.1 million in nonmatching funds. Projects involving land conservation have affected about 1.9 million acres of bird habitat. Habitat protection, restoration and management is the highest priority, but monitoring, research, law enforcement and education/outreach are also supported.

A staggering 1,810 partners applied for or received grants for bird conservation projects, and there has been an overall non-federal/federal match of a whopping 4:1. With the huge demonstrated conservation need, the showcase leveraging of federal funds and the hundreds of eager partners getting projects set up, it has both surprised and dismayed us that the funding authorizations and appropriations have not increased to the recent goal of $10 million. Indeed, a goal of $20 million is justified.

Saving Our Shared Birds–The Partners in Flight Tri-National Vision

"Saving Our Shared Birds" (Berlanga et al. 2010) was the latest in a series of ever more comprehensive conservation assessments conducted by PIF. Mexico, Canada and the continental United States are home to 882 native landbird species. The distribution of these species changes from fewer species but with larger populations in the North, to more species but with smaller populations in the South. But a key point - one that is reflected in the title - is that more than one-third of these species depend substantially on habitats in more than one country. In fact, more than 200 species and more than 83 percent of individual landbirds rely on habitats in all three countries every year.

Thus, it became abundantly clear that to be truly effective in conservation, we must consider at least the scale of the continent. This does not mean we have to be overwhelmed by scale. For example, the tropical forests in Mexico provide critical wintering habitat for more than 60 shared migratory species. These same forests provide year-round habitats for 70 percent of our species of highest concern. These clear linkages compel us to work internationally.

PIF also has identified 148 bird species in need of immediate conservation attention. These include: 44 species with very limited distributions, mostly in Mexico, that are at greatest risk of extinction; 80 tropical residents dependent on deciduous, highland and evergreen forests in Mexico; and 24 species that breed in temperate-zone forests, grasslands and aridland habitats. And there are another 42 relatively common bird species that have experienced steep population declines, resulting in the loss of 800 million birds over the past 40 years. The resulting loss of beauty, biodiversity and ecosystem services from the continent are sobering. There are yet more species of concern in Hawaii and the Caribbean, all awaiting much more attention in the near future.

The Power of Partnerships

Partners in Flight shares the theme of International Migratory Bird Day for 2010: The Power of Partnerships. The more than 1,800 partners who have obtained or applied for NMBCA funding (see above) illustrate the breadth and potential power that we must bring to bear on the growing problems.

We can achieve our goals, but the window is rapidly closing. We need to take immediate action in six main areas.

1. Protect and Recover species at greatest risk--a strong network of protected areas will support highest concern landbirds that depend on tropical forests in Mexico.
2. Conserve habitats and ecosystem functions--relatively small policy changes can have dramatic cumulative benefits to birds in many habitats. Sustainable agriculture, forestry and urban planning can provide core areas of habitat within altered landscapes.
3. Reduce sources of direct mortality--providing alternative livelihoods can reduce unsustainable hunting and trapping for the cage bird trade. We must discover and implement measures to reduce other sources of mortality, such as collisions with windows and tall structures, pesticides, and domestic cats.
4. Increase the power of partnerships--Regional Alliances, international Joint Ventures and community-based partnerships are successful models for communication, collaboration and expanded funding. New mechanisms for engaging business, industry and nongovernmental sectors are necessary.
5. Expand our knowledge base for conservation--effective conservation programs require an increased understanding of distribution patterns, seasonal connectivity and factors limiting bird populations. We also need to better understand the response of populations to management practices and the cumulative effects of human-caused mortality.
6. Engage people in conservation action--because human activities are the primary force driving population declines, a more engaged society will be necessary to conserve habitats and reverse declines. Shared products and programs can increase participation by bird enthusiasts in citizen science and promote economic gain for people who rely on birds or bird habitats for their livelihoods.

Partners in Flight has done well over the past 20 years, but the most serious tests lie ahead. What will the partnership look like in 2030? Will we be eager to take the microphone?

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Hawaiian Birds: Out of Sight?

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Natural History

Hawai'i is the most isolated island archipelago in the world, lying more than 2,000 miles (3,200 km) southwest of the U.S. mainland. It is comprised of 132 islands spread across 1,500 miles (2,400 km). Hawai'i is best known for its eight main islands of Ni'ihau, Kaua'i, O'ahu, Moloka'i, Lāna'i, Kaho'olawe, Maui, and Hawai'i, or the Big Island. The island chain lies over a volcanic hotspot. Over millions of years, the Pacific Plate's gradual movement over the hot spot has created the series of islands that continues to drift slowly to the northwest. The Big Island is the newest island and is still volcanically active. Twenty-seven million year old Kure Atoll is the oldest and most distant of the northwestern Hawaiian Islands.

Over millions of years, Hawai'i was gradually colonized by plants and animals, including birds. Due to its isolation, Hawai'i boasts an amazing proportion of endemic plants and animals with 90 percent, more than 10,000 species, of all native species being found nowhere else in the world (Ziegler 2002). Prior to the arrival of humans, the Hawaiian archipelago supported a remarkable avifauna comprised of at least 113 endemic species, including flightless geese, ibis, rails, and a radiation of at least 59 species of Hawaiian honeycreepers (Olson and James 1991, James and Olson 1991, James 2004).

Conservation Need

Since human colonization, 71 birds have become extinct, 48 prior to the arrival of Europeans and 23 since Captain James Cook's "discovery" of Hawai'i in 1778 (Olson and James 1991, James and Olson 1991, Pyle 1997, Banko et al. 2001). Today, Hawai'i supports 69 native species, although 10 of these may well be extinct (Table 1). Of the 42 extant endemic taxa, 31 (29 species and 2 sub-species) are federally listed under the Endangered Species Act (ESA), 2 are proposed for listing and 1 is a candidate for listing. The most distinctive components of the present-day Hawaiian avifauna are the honeycreepers which make up 23 endemic species, of which 14 species are listed under the ESA. The honeycreepers display an amazing range of bill types, representing adaptations to many different foods, from the stocky finch bill of the seed-eating Palila (*Loxioides bailleui*) to the spectacularly decurved bill of the insectivorous 'Akiapōlā'au (*Hemignathus munroi*), and stout, hooked bill of the Maui Parrotbill, which feeds on insects it extracts from plant material by tearing. There are two extant species of endemic thrushes, the Oma'o (*Myadestes obscurus*) and Puaiohi (*M. palmeri*), with the latter being listed under the ESA. Two other thrushes, the Kāma'o (*M. myadestinus*) and the Oloma'o (*M. lanaiensis*), have not been seen for a number of years.

Several waterbirds and shorebirds are endemic to Hawai'i and are endangered under the ESA, such as the Hawaiian Coot (*Fulica alai*) and the Black-necked (Hawaiian) Stilt (*Himantopus mexicanus knudseni*). All three endemic waterfowl species are listed as endangered. Twenty-two (32 percent) of Hawai'i's 69 native bird species are seabirds, including 2 listed as endangered or threatened, the Townsend's (Newell's) Shearwater (*Puffinus auricularis newelli*) and the Hawaiian Petrel (*Pterodroma sandwichensis*). For a listing of Hawai'i's listed species, see Table 1. Midway Atoll National Wildlife Refuge has the world's largest Laysan (*Phoebastria immutabilis*) and Black-footed albatross (*P. nigripes*) colonies. In addition, many waterfowl and shorebirds occur in Hawai'i as transients and winter residents.

Many Hawaiian birds, especially passerines, are in decline (Gorresen et al. 2009). For example, the Palila, endemic to the Big Island, has declined significantly over the past eight years from an estimated 6,633 individuals in 2003 to 2,512 individuals in 2009 (U.S. Geological Survey unpublished data). Similarly, the Akikiki (*Oreomystis bairdi*) and 'Akeke'e (*Loxops caeruleirostris*) of Kaua'i have declined dramatically since surveys began in 1970 and are proposed for listing under the ESA (U.S. Fish and Wildlife Service 1983, Scott et al. 1986, Foster et al. 2004, Hawai'i Division of Forestry and Wildlife and U.S. Geological Survey unpublished data.). Notable exceptions to this trend include Hawai'i (*Hemignathus virens*), O'ahu (*H. flavus*), and Kaua'i amakihi (*H. kauaiensis*), the widespread 'Apapane (*Himatione sanguine*), 'Io or Hawaiian Hawk (*Buteo solitarius*), Hawaiian Coot, and Hawaiian Stilt.

Threats and Their Causes

Habitat destruction, non-native diseases and predators, and habitat degradation by introduced ungulates and invasive plants are the main threats now facing Hawai'i's remaining endemic birds (Van Riper and Scott 2001, U.S. Fish and Wildlife Service 2006, VanderWerf 2009).

The leading threats to Hawaiian birds are habitat loss from clearing, fire, agriculture and development; predation by non-native predators, e.g., feral domestic cats (*Felis catus*), small Indian mongoose (*Herpestes javanicus*) and rats, both black (*Rattus rattus*) and Polynesian (*R. exulans*); habitat degradation due to introduced ungulates, especially feral pigs (*Sus domestica*), sheep (*Ovis aries*), goats (*Capra aegagrus*), cattle (*Bos primigenius*) and two species of deer; habitat degradation due to exotic, invasive plants, e.g., strawberry guava (*P. cattleianum*); introduced plant diseases, e.g., 'ohia rust (*Puccinia psidii*) which threatens the 'ohia tree (*Metrosideros polymorpha*), one of the most important food plants of Hawaiian honeycreepers; and introduced insects which prey on or parasitize native invertebrates, degrade habitat in some areas, e.g., defoliation on Nihoa by irruptions of the alien gray bird grasshopper (*Schistocerca nitens*), and serve as vectors for introduced pathogens.

Habitat loss following the colonization of the islands by humans has been extensive, with approximately only 30 percent of the native habitat remaining. Most Hawaiian bird species are closely associated with native habitat and therefore highly restricted in range, persisting in relatively small populations. Even most areas where native habitat is relatively intact are degraded to some degree due to the presence of introduced species that reduce native biodiversity and thereby affect the suitability of foraging and nesting sites. Management of Hawai'i's avifauna will require protection of remaining native habitat as well as landscape restoration of habitat that has been lost (Price et al. 2009). Availability of suitable, manageable habitat is critical and fundamental to the success of avian conservation in Hawai'i, yet this aspect of conservation need is constrained by issues related to land ownership and conflicts in land designation and use.

Fifty-eight percent of Hawai'i's land area is in private ownership. As elsewhere, many landowners in Hawai'i are reluctant to encourage the presence of listed threatened and endangered species on their lands because of liability issues from the ESA. In addition, many lands are zoned or designated for uses that are not compatible with native bird conservation, such as lands zoned for agriculture or development, and lands that are designated for multiple uses, such as recreation and hunting of introduced ungulates, that may limit the effectiveness of management for native biodiversity. The Division of Forestry and Wildlife, for example, the primary government land manager responsible for conservation of Hawai'i's birds, is also required to establish, maintain, manage and operate game management areas and public hunting areas. Areas designated for sustainable game management are usually not compatible with conservation of native biodiversity.

Exotic insects spread alien diseases to which native birds have no innate resistance (Atkinson and Lapointe 2009). The southern house mosquito (*Culex quinquefasciatus*) was introduced in 1826 on Maui and is now present throughout most of Hawai'i. Mosquitoes are responsible for the spread of avian malaria (*Plasmodium* sp.) and avian pox (*Avipoxvirus* sp.) which have caused multiple avian extinctions. Most native bird species are now largely restricted to forests above 4,921 feet (1,500 m) where temperatures are generally too low for mosquitoes and disease transmission.

All of Hawai'i's extinctions since the arrival of Europeans and current bird conservation crises are directly traceable to introduction of non-native organisms. One of the greatest potential threats is the accidental introduction of the brown tree snake (*Boiga irregularis*), which has devastated birdlife on Guam. Nine species have been extirpated by the snake, leaving the Mariana Crow (*Corvus kubaryi*) as the only native forest bird remaining in the wild (Fritts and Leasman-Tanner 2001), although the population is now comprised of four males. Since 1981, at least eight brown tree snakes have made it to O'ahu by airplane. Most were found dead or dying near airport runways, and all were captured shortly after arriving. Brown tree snakes are not established in Hawai'i, but constant vigilance is required to avert this

Table 1. Extant native Hawaiian bird species summary (69 species). This list includes several species presumed to be extinct. Recent genetic analysis suggests that Elepaio populations on Kauai, Hawaii and Oahu represent three distinct species; IUCN status not yet determined. Key: Hawaiian abundance: bp=breeding pairs; Distribution: MHI=Main Hawaiian Islands, NWHI=Northwest Hawaiian Islands; Federal and State status: E=Endangered, T=Threatened, P=Proposed, C=Candidate, MBTA=Migratory Bird Treat Act; IUCN Status: International Union for the Conservation of Nature: EX= Extinct, CR=Critically Endangered, EN=Endangered, VU=Vulnerable, NT=Near-threatened; Trend: U=unknown, S=stable, I=increasing, D=decreasing; Predators: C=cats, R=rats, M=mongoose, H=Hawaiian Hawk, Habitat degradation: AP=alien plants, AI=alien insects, Ung=ungulates; Disease: N[CR]= Not in current range, but could change with climate change. From D. Leonard, Hawaii Department of Land and Natural Resources (personal communication); updated.

Common name	Hawaiian name	Scientific name	Hawaiian abundance	Distribution	Federal status	State status	IUCN status	Trend	Predators	Habitat degradation	Disease	Small Pop / Dist	Climate change
Laysan Albatross	Mōlī	*Phoebastria immutabilis*	590,000 bp	NWHI, Kaua`i, O`ahu	MBTA		VU						Y
Black-footed Albatross	Ka`upu	*P. nigripes*	55,000 bp	NWHI, Kaua`i	MBTA		EN						Y
Hawaiian Petrel	`Ua`u	*Pterodroma sandwichensis*	4,500 - 5,000 bp	MHI (except Lana`i)	E	E	VU	U	C, R, M	AP, Ung	N	?	?
Bonin Petrel		*Pterodroma hypoleuca*	270,000 - 395,000 bp	NWHI	MBTA								
Bulwer's Petrel	`Ou	*Bulweria bulwerii*	75,000 - 105,000 bp	NWHI, MHI	MBTA								
Wedge-tailed Shearwater	`Ua`u kani	*Puffinus pacificus*	270,000 bp	All	MBTA								
Christmas Shearwater		*P. nativitatis*	3,000 bp	NWHI, MHI	MBTA								
Newell's Shearwater	`A`o	*P. auricularis newelli*	14,000 bp	MHI; mostly Kaua`i	T	T	EN	D	C, R, M	AP, Ung	N	?	?
Band-rumped Storm-Petrel	`Akē`akē	*Oceanodroma castro*	175,000 - 225,000 bp	Kaua`i	C	E							
Tristram's Storm-Petrel		*O. tristrami*	10,000 bp	NWHI	MBTA		NT						
White-tailed Tropicbird	Koa`e	*Phaethon lepturus*	1,800 bp	NHWI, MHI	MBTA								
Red-tailed Tropicbird	Koa`e`ula	*P. rubricada*	9,000 - 12,000 bp	NWHI, MHI	MBTA								
Masked Booby	`Ā	*Sula dactylatra*	3,000 bp	NWHI, MHI	MBTA								
Brown Booby	`Ā	*S. leucogaster*	1,400 bp	NWHI, MHI	MBTA								
Red-footed Booby	`Ā	*S. sula*	7,000 - 11,000 bp	NWHI, MHI	MBTA								
Great Frigatebird	`Iwa	*Fregata minor*	10,000 bp	NWHI, MHI	MBTA								
Black-crowned Night-Heron	`Auku`u	*Nycticorax nycticorax*	At least 400	MHI	MBTA			S					
Hawaiian Goose	Nēnē	*Branta sandvicensis*	1,300	MHI (except Lana`i)	E	E	VU	I	C, R, M	No	?	?	?
Hawaiian Duck	Koloa maoli	*Anas wyvilliana*	2,500	MHI	E	E	EN	S	C, R, M	No	?	?	?

Laysan Duck		*Anas laysanensis*	500	NWHI	E	E	CR	S / I	No	No	Y	Y	Y
Hawaiian Hawk	`Io	*Buteo solitarius*	1,500	Big Island	E	E	NT	S	No	AP	WN	Y	?
Hawaiian Coot	`Alae ke`oke	*Fulica alai*	3,000	MHI	E	E	VU	S	C, R, M	AP	Y	Y	?
Common (Hawaiian) Moorhen	`Alae `ula	*Gallinula chloropus sandvicensis*	300	MHI	E	E		S	C, R, M	AP	Y	Y	?
Pacific Golden-Plover	Kōlea	*Pluvialis fulva*	90,000	All	MBTA								
Wandering Tattler	`Ūlili	*Heteroscelus incanus*	Unknown	NWHI, MHI	MBTA								
Bristle-thighed Curlew	Kioea	*Numenius tahitiensis*	800+	NWHI, MHI	MBTA								
Ruddy Turnstone	`Akekeke	*Arenaria interpres*	Unknown	NWHI, MHI	MBTA								
Black-necked (Hawaiian) Stilt	Ae`o	*Himantopus mexicanus knudseni*	1,400	MHI	E	E		S	C, R, M	AP	Y	Y	?
Gray-backed Tern	Pākalakala	*Sterna lunata*	44,000 bp	NWHI; O`ahu	MBTA								
Sooty Tern	`Ewa`ewa	*S. fuscata*	1,000,000 bp	NWHI; O`ahu	MBTA								
Brown Noddy	Noio Kōhā	*Anous stolidus*	112,000 bp	NWHI; O`ahu	MBTA								
Black Noddy	Noio	*A. minutus*	12,000 bp	NWHI; O`ahu	MBTA								
Blue-gray Noddy		*Procelsterna cerulea*	3,600 bp	NWHI	MBTA								
White Tern	Maun-o-Kū	*Gygis alba*	15,000 bp	NWHI, O`ahu	MBTA								
Short-eared Owl	Pueo	*Asio flammeus sandwichensis*	Unknown	MHI	MBTA	E - O`ahu			?	?	?	N	?
Kaua`i `Ō `Ō	`Ō `Ō `ā `ā	*Moho braccatus*	?	Kaua`i	E	E	EX	1987	na	na	na	Y	na
Hawaiian Crow	`Alalā	*Corvus hawaiiensis*	60	Big Island	E	E	EW	D to S	C, R, M, H	AP, Ung	Y	Y	Y
Kaua`i `Elepaio		*Chasiempis sandwichensis sclateri*	152,000	Kaua`i	None	None	EN	I	R	No	Y	No	?
O`ahu `Elepaio		*C. s. ibidis*	2,000	O`ahu	E	E	EN	D	C, R, M	No	Y	Y	?
Hawai`i `Elepaio		*C. s. sandwichensis*	200,000	Big Island	None	None	EN	D / I	R	No	Y	No	?
Large Kaua'i Thrush	Kāma`o	*Myadestes myadestinus*	?	Kaua`i	E	E	CR	1991	na	na	na	Y	na
Moloka`i Thrush	Oloma`o	*M. lanaiensis ruthra*	?	Moloka`i	E	E	CR	1988	na	na	na	Y	na
Hawai`i Thrush	`Ōma`o	*M. obscurus*	170,000	Big Island	None	None	VU	D / S	C, R, M	AP, Ung	?	N	?
Small Kaua`i Thrush	Puaiohi	*M. palmeri*	500	Kaua`i	E	E	CR	D?	C, R	AP, Ung	?	Y	Y

Millerbird		*Acrocephalus familiaris kingi*	400	Nihoa	E	E	CR	S	na	AI	?	Y	?
Nihoa Finch		*Telespize ultima*	3,000	Nioha	E	E	CR	D	na	AI	?	Y	?
Laysan Finch		*Telespiza cantans*	10,000	Laysan	E	E	VU	S	na	?	?	Y	Y
Ō `ū		*Psittirostra psittacea*	?	Kaua`i, Big Island	E	E	CR	1989	na	na	na	Y	na
Palila		*Loxioides bailleui*	2,600 - 3,000	Big Island	E	E	CR	D	C, R, M	AP, AI, Ung	*N [CR]*	Y	Y
Maui Parrotbill		*Pseudonestor xanthophrys*	500	Maui	E	E	CR	S?	?	N	*N [CR]*	Y	Y
Hawai`i Amakihi		*Hemignathus virens*	850,000	Big Island	None	None	LC	S / I	N	N	N	N	?
O'ahu Amakihi		*H. flavus*	52,000	O`ahu	None	None	VU	S / I	N	N	N	N	?
Kaua`i Amakihi		*H. kauaiensis*	51,000	Kaua`i	None	None	VU	I	N	N	N	N	?
Anianiau		*H. parvus*	37,500	Kaua`i	None	None	VU	I	N	N	*N [CR]*	N	?
Kaua`i `Akialoa		*Hemignathus procerus*	?	Kaua`i	E	E	EX	1969	na	na	na	Y	na
Nukupu`u		*H. lucidus*	?	Kaua`i, Maui	E	E	CR	1996	na	na	na	Y	na
Akiapōlā`au		*H. munroi*	1,900	Big Island	E	E	EN	D	C, R, M	AP, Ung	*N [CR]*	Y	Y
Kaua`i Creeper	Akikiki	*Oreomystis bairdi*	3,600	Kaua`i	P	None	CR	D	C, R	AP, Ung	Y	Y	Y
Hawai`i Creeper		*O. mana*	14,000	Big Island	E	E	EN	D / I	C, R, M	AP, Ung	*N [CR]*	?	Y
O`ahu Creeper	`Alauahio	*Paroreomyza maculate*	?	O`ahu	E	E	CR	1985	N	N	*N [CR]*	N	na
Moloka`i Creeper	Kāwāwahie	*P. flammea*	?	Moloka`i	E	E	EX	1963	na	na	na	Y	na
Maui Creeper	`Alauahio	*P. montana*	35,000	Maui	None	None	EN	S?	N	N	*N [CR]*	N	Y
Kaua`i Ākepa	Akeke`e	*Loxops caeruleirostris*	7,900	Kaua`i	P	None	EN	I?	C, R	AP, Ung	Y	Y	Y
Maui Ākepa		*Loxops coccineus ochraceus*	?	Maui	E	E	EN	1988	na	na	na	Y	na
Hawai`i Ākepa		*L. c. coccineus*	15,000	Big Island	E	E	EN	D / I	N	AP, Ung	*N [CR]*	?	Y
I`iwi		*Vestiaria coccinea*	360,000	MHI (except Lana`i)	None	E - O`ahu	VU	D / I	N	N	Y	N	Y
Crested Honeycreeper	Ākohekohe	*Palmeria dolei*	3,700	Maui	E	E	CR	S?	?	N	*N [CR]*	Y	Y
`Apapane		*Himatione sanguinea*	1,300,000	MHI	None	None	LC	I	N	N	N	N	?
Po`ouli		*Melamprosops phaeosoma*	?	Maui	E	E	CR	2004	na	na	na	Y	na

disaster. Maintenance of existing biosecurity measures and increasing biosecurity both among the Hawaiian Islands and between Hawai'i and other places are extremely important. Increased funding is needed to increase cargo screening on all modes of transportation.

Climate change will add to or exacerbate the threats to Hawaiian birds. These include habitat loss for coastal species, an increase in alien plants and an increase in hurricanes, which can devastate native forests and bird populations, especially those with limited ranges. However, the greatest threats are the expansion of avian disease and reduction of safe forest habitat. If a warming climate results in diseases moving upslope, one potential solution is to plant forests above the current tree line. However, climate may change faster than it is practical or biologically possible to establish new forests. The tropical inversion layer, which forms as cool, dry air meets warm, moist air, caps moisture and cloud development between 5,905 and 7,874 feet (1,800-2,400 m). Over the past two decades, the altitude of this layer has remained fairly stable in spite of warming trends, and it appears to be forming more often and persisting for longer periods. If these trends continue, a lack of moisture will prevent trees from growing above the current tree line.

Recovery Needs

The recovery actions that are needed to stabilize and recover Hawai'i's native avifauna are identified in a number of planning documents that range from very broad strategic-level planning, such as State Wildlife Action Plans and U. S. Fish and Wildlife Service (USFWS) Regional Plans, to species-specific recovery and short-term implementation plans, such as USFWS recovery plans. These plans identify the suite of conservation actions that must be implemented across the landscape to achieve effective conservation. This work will require an integrated approach to: 1) ensure that sufficient manageable habitat is available or acquired; 2) construct and maintain hundreds of miles of fences to exclude ungulates, including many specialized fences also capable of excluding cats, rodents and dogs; 3) restore degraded or destroyed habitats; 4) manage predators using conventional methods, such as trapping, as well as the development and use of safe landscape-scale broadcast of rodenticides; 5) ensure the prevention, early detection and control of invasive species that pose threats; 6) ensure prevention and suppression of wildland fires; and 7) conduct research and monitoring to guide recovery planning. This comprehensive approach to management and recovery of Hawai'i's birds is expected to require effective management of more than 1,250,500 acres (506,072 ha) of land at a cost of more than $2 billion over the next 30 years.

Recovery Implementation

A wide variety of conservation measures are being employed in Hawai'i (Leonard 2008, Price et al. 2009), and all need to be increased in scope to avoid additional extinctions. Among the highest priority actions with the greatest potential impact is the fencing of remaining high-quality natural habitat to exclude feral ungulates and the subsequent removal of ungulates from the fenced areas. These actions improve habitat quality, reduce the amount of mosquito breeding habitat and focus the control of other limiting factors in critical areas (Atkinson and Lapointe 2009). Nesting success and survivorship of adults and young can be increased through predator control within fenced areas through direct trapping. Work of this kind is underway for the Palila on the Big Island and for the Maui Parrotbill (*Pseudonestor xanthophrys*). Predator-proof fences may be an option for certain locations, but are considerably more expensive. Rodenticides hold promise for reducing numbers of rodents, especially rats. The rodenticide diphacinone was recently approved for aerial application in Hawai'i, opening up the possibility for much more cost effective use of rodenticides over large areas where it can be used safely (Howald et al. 2005). There is also an urgent need for targeted efforts to reduce the spread of invasive, exotic plants in areas important to threatened birds.

Species whose numbers have become critically low require captive breeding to insure that captive populations exist so that they can be re-introduced when habitat conditions are improved, as in the case of 'Alalā or Hawaiian Crow (*Corvus hawaiiensis*), which is extinct in the wild (U.S. Fish and Wildlife Service 2009), and to bolster wild populations, as is being done with the Puaiohi on Kaua'i. Translocation of individuals will be useful to create insurance populations for species restricted to single sites, such as the Millerbird (*Acrocephalus familiaris*). Endangered Laysan Ducks (*Anas laysanensis*) have been translocated successfully from Laysan to Midway where the population now exceeds 200 birds. Selected smaller offshore islands are being considered as sites for the creation of "island arks" where some Hawaiian native species could be released into a predator-free environment. The largest uninhabited island, Kaho'olawe, holds great promise for a predator-free refuge for waterbirds and seabirds.

Reducing the incidence of avian malaria and avian pox is the greatest Hawaiian bird conservation challenge (Atkinson and Lapointe 2008, Atkinson and Lapointe 2009). While reducing habitat degradation by ungulates may have some benefit in reducing available mosquito breeding habitat, there are currently few other tools available to combat these diseases. Relatively small-scale projects to eliminate mosquitoes from discrete areas using insecticides or a new technique

known as cytoplasmic incompatibility may be feasible in some cases. Evolved resistance seems possible for at least some species, based on Amakihi populations on most islands which now occur below 300 feet (91 m) elevation. These species now are apparently on the road to tolerating malaria and have initiated a remarkable and rapid recovery. Modeling suggests that reducing mortality from other factors (e.g., nest predation) can facilitate the development of disease resistance (Kilpatrick 2006).

Management actions that are currently being conducted will ameliorate some of the effects of climate change (Benning et al. 2002, Atkinson and Lapointe 2008, Pratt et al. 2009). However, more populations of all endangered birds need to be created, including outside of their known ranges using translocation and/or the release of captive bred birds, attempts to expand high-elevation forests need to be implemented, selection for disease resistant individuals needs to be facilitated, and methods for keeping high elevation forests free of disease vectors need to be developed. Non-climate stressors (e.g., predators) need to be reduced across large areas to facilitate selection for disease resistance (Kilpatrick 2006).

The Role of Partnerships

The threats to Hawaiian birds are present at landscape scales, and most species face multiple threats. Effective conservation strategies and actions must address the full suite of threats at the landscape scale at enormous cost, yet only a small fraction of the funding needed is actually available (Leonard 2008). In light of the magnitude and scale of the conservation measures needed, broad public/private partnerships are the only realistic hope for effective conservation at the present time, especially in the current economic climate.

In recent years, a broad network of conservation partnerships has emerged to address some of the most significant and overarching challenges and constraints to conservation in Hawai'i. These partnerships have become increasingly successful at leveraging and securing funding and personnel, increasing the inventory of lands available for management, particularly by engaging private landowners, and galvanizing public and political support for conservation efforts.

Notable examples include:

1) The creation of public/private landscape watershed partnerships. Watershed partnerships are voluntary alliances of contiguous public and private landowners that agree to cooperate for watershed protection and conservation. There are now 10 watershed partnerships statewide, with at least 1 on each of the 6 largest main islands, that protect approximately 2 million acres (809,717 ha) of habitat available for the management of biodiversity. These partnerships have been highly effective in advancing conservation goals for biodiversity in Hawai'i. For example, management of bird recovery habitat on Maui, as on all islands, poses significant challenges because much of the recovery lands are privately owned, designated for uses other than conservation, or highly degraded or destroyed. Watershed partnerships have now been created on West Maui, East Maui and Leeward East Maui, and these partnerships encompass nearly completely the recovery lands identified for Maui's forest birds. The establishment of these partnerships effectively superimposes conservation goals onto the social and political framework, creating a process for dialogue, planning, funding and implementation of conservation programs. On Maui, for example, the West Maui Watershed Partnership has been successful in securing support for ungulate removal on virtually all the partnership lands, a series of fences have been constructed in the East Maui Watershed Partnership, with ungulate removal accomplished or underway in those areas, and a new series of fences being constructed to remove ungulates from lower elevations on East Maui and across the leeward side where forest restoration is needed. Together, these partnership efforts will implement the removal of invasive ungulates from a significant portion of forest bird recovery habitat, representing a critical first step in the management of these areas as suitable habitat for native birds. Similar initiatives and actions are underway on all the main islands.
2) The Hawai'i Invasive Species Council (HISC) was created by administrative and statutory initiative in 2003 to implement a statewide program for the prevention, early detection and control of invasive species. HISC is an interdepartmental collaboration that has been funded at $2 to $4 million per year. The funds are used to monitor and prevent entry of new invasive species, and to deploy field teams on each of the islands to combat incipient and established invasive species.
3) The establishment of the Legacy Lands Act in 2005 created a dedicated source of funds for acquisition and management of conservation lands. The funds have been used in recent years to support and supplement an aggressive acquisitions program that has secured tens of thousands of acres of conservation habitat, and have been providing around $8 to $10 million per year for the management of biodiversity and watershed integrity.
4) The organization of planning and advocacy initiatives that bring together private and public partners to facilitate the exchange of information, galvanize public and political support, plan and implement

management and recovery initiatives for Hawaiian avifauna, and lobby the legislature to enhance the effectiveness of conservation efforts.

Discussion and Future Needs

Despite the urgency of the situation, the plight of the archipelago's avifauna is underappreciated and underfunded. A recent analysis of federal spending on bird species listed under the Endangered Species Act documented that even though Hawaiian birds comprise one-third of all listed bird species, only 4.1 percent of all federal and state funds dedicated to recovery efforts for listed species are directed at Hawaiian species (Leonard 2008). In addition, not all species of native Hawaiian birds are accorded federal protection. Hawaiian honeycreepers are specifically not protected under the Migratory Bird Treaty Act (MBTA) even though they are members of the finch family which is protected under the MBTA. As a result, some species that are not listed under the ESA may receive no federal protection at all, such as 'I'iwi (*Vestiaria coccinea*), 'Apapane and others.

Why is it that Hawaiian birds are so effectively out-of-sight and out-of-mind? One reason is general lack of awareness about Hawai'i's avifauna (Leonard 2008, 2009). Most mainland U.S. residents and birdwatchers have never been to Hawai'i and have little knowledge of Hawaiian birds. Until very recently, the plight of Hawaiian birds received little national attention, and part of this is a lack familiarity with Hawaiian birds, which stems from a number of factors such as their exclusion from U.S. bird books and the simple fact that Hawai'i is thousands of miles from Washington, D.C. With many of Hawai'i's listed birds confined to high-elevation forests where access is difficult or impossible, opportunities to see native birds, or the results of conservation projects to protect them, are limited. Unfortunately, even among Hawaiian residents, there is little awareness or connection with native birds. As a result, there is little call from the public for increased funding and conservation action.

The lack of funding for Hawai'i's endangered bird species has many roots. Recovery spending is, unfortunately, not always based on need, but rather on economic and/or political conflict. Endangered species without associated economic conflicts generally receive less funding and less attention. In general, this is the case for Hawai'i's listed birds, unlike the Spotted Owl (*Strix occidentalis*) or Red-cockaded Woodpecker (*Picoides borealis*), for instance, where conservation of the species is pitted against economic interests. Hawai'i only has one conflict species – the 'Alalā, whose history illustrates that conflict can generate awareness and often funds for research and mitigation (Leonard 2009). Much of the support for the two Hawaiian passerines that receive the most funding (the Hawaiian Crow and Palila) has resulted from lawsuits which require the U.S. Fish and Wildlife Service (USFWS) and the state to expend human and monetary resources on species named in legal actions. The majority of such law suits involve mainland species and may result in funds being diverted from extinction-prone Hawaiian species. Other causes of inadequate funding spring from Hawai'i's low population size, which results in a low tax base, reduced representation in Congress, and only a 1 percent share of funds from the State Wildlife Grants program, an important funding source for work on non-game species. The small geographic ranges of Hawaiian birds contribute to reduced funding because allocation of recovery funds by the USFWS is based partly on geographic range. Finally, Hawai'i shares no borders or species with other states and therefore cannot cost share conservation efforts.

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Beyond Our Borders: Protecting Tropical Forests for Wisconsin's Neotropical Migratory Birds

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There has been long-standing recognition that tropical forests are important for neotropical migrants, but considerable debate about just how important. Ongoing scientific investigation is in the process of laying that debate to rest. Recent work done by the Institute for Bird Population Studies revealed both first-year survival and adult survival were the most important drivers of spatial variation in population trends for numerous neotropical migrants (DeSante and Sarraco 2009). Translation–for certain species, survival of juveniles and adults is largely a function of habitat conditions on wintering grounds and migration routes. Conclusion–everything we do to protect and manage breeding habitat for those species will be of little value if we don't also protect their migratory stopover sites and wintering habitat.

For the last two decades, the State of Wisconsin has invested heavily in protection of the state's natural resources. Since 1980, via the nationally recognized Knowles-Nelson Stewardship Program, Wisconsin has spent approximately $494 million to acquire more than 484,000 acres (171,589 ha) of habitat considered vital for breeding birds and other resident wildlife. While important, in-state habitat protection strategies have not fully addressed the needs of migratory birds. Until recently, the missing factor in the calculus of Wisconsin's bird conservation efforts has been wintering habitat protection.

Historically, Wisconsin's international bird habitat conservation efforts focused on protection of waterfowl breeding habitat in Canada, strategically important for that group of birds, but limited in scope when considering the state's rich avifauna. More than half of Wisconsin's 238 species of breeding birds are considered neotropical migrants, annually migrating thousands of miles southward to wintering grounds in Latin America (Matteson and Foote-Martin 2004). Many spend more time in tropical winter haunts than on temperate breeding grounds.

Recognizing the need to implement full life cycle stewardship–protecting breeding, migratory and wintering habitats–in 2005, the Wisconsin Bird Conservation Initiative (a statewide alliance of 160+ partner organizations) established an international program to advance conservation of neotropical migrant wintering habitat in Latin America.

The program is staffed by volunteers and does not have a budget. Thus, initial efforts to support conservation activities, particularly land acquisition, relied on funds generated by "conservation birding" trips–bird-watching ventures designed to raise funds for Latin American Non-government Conservation Organizations (NCOs) (Thompson 2009). The results are impressive. Since 2006, more than $55,000 (U.S.) has been raised, benefitting bird conservation projects in Ecuador, Panama and Costa Rica. Still, the lack of institutional support for wintering ground conservation has limited the overall impact of the program.

Southern Wings Takes Flight

Conceived in 2008, the Association of Fish and Wildlife Agencies' (AFWA) Southern Wings Program (SW) provides a vehicle to facilitate states' involvement in wintering ground protection throughout Latin America and the Caribbean. The program is biologically based, enabling states to support conservation of core wintering areas relevant to their breeding birds. One-to-one match requirements ensure a state's contribution to the program is leveraged. Program mechanics are as follows:

1. The American Bird Conservancy (ABC), a leading international bird conservation organization with a strong presence in Latin America, presents a slate of projects to the Southern Wings Technical Committee. While geographically diverse, projects offered by ABC share similar characteristics including biological relevance for states, in-country partners, well-defined needs and a budget.
2. Members of the SW Technical Committee (made up of representatives from member states, AFWA and ABC) work cooperatively to select projects for funding. States are encouraged to partner, thereby increasing available funding for any given project.
3. States provide funds to their regional associations–Western, Midwest, Southeast and Northeast (all fall under the umbrella of AFWA)–who in turn provide those funds to ABC.
4. ABC transfers funds to the in-country NCO. Funds are applied to designated projects.

Wisconsin Steps Up

Recognizing the compelling need to protect wintering grounds for its migratory birds, in 2008 the Wisconsin Department of Natural Resources (WDNR) made a decision to support migratory bird habitat protection efforts in Latin America. After exploring possibilities with ABC, WDNR decided to join a partnership focused on protecting a highly threatened property located on the Osa Peninsula of Costa Rica.

Cerro Osa, as the property is known, is magnificent–1,500 largely forested acres (607 ha) offering stunning views of the Pacific Ocean. The owner, an eleven-member partnership based in Florida, decided to develop the property for a resort and luxury homes, despite the presence of a conservation easement. Technical problems with the easement left the property in jeopardy. The only solution was purchase. The price tag was a whopping $3.2 million (U.S.).

Cerro Osa is situated on the southern end of a large peninsula that juts into the Pacific Ocean. The Osa, as it is know to those who frequent the area, is considered a global conservation priority due to high species richness and high levels of endemism. The peninsula harbors Central America's last large block of Isthmian Moist Forest, a forest type considered among the most endangered in Latin America (Dinerstein et al. 1995). It also supports the largest remaining mangrove forests in Mesoamerica. Moreover, the peninsula falls within the South Central America Pacific Slope Endemic Bird Area (Birdlife 2003) and has been designated an Alliance for Zero Extinction (AZE) site due to the presence of the globally endangered Black-cheeked Ant Tanager (*Habia atrimaxillaris)* (AZE 2005).

Close examination of the peninsula's substantial bird list reveals 54 species that breed in Wisconsin, 18 of which are considered conservation priorities (Wisconsin Wildlife Action Plan 2005). Thus, investing in protection of Cerro Osa would not only help protect important neotropical migrant wintering habitat for Wisconsin's birds, but would also contribute to the protection of a site with globally significant biodiversity.

A key factor in Wisconsin's decision to participate was the presence of an in-country partner with organizational capacity. Since 2003, Friends of the Osa (FOO), a Costa Rican non-profit conservation organization, has skillfully cultured a growing awareness of the Osa's biological treasures and the need to protect them. Not strictly a bird conservation organization, FOO has an ambitious, focused mission–ensure the Osa's forests are worth more standing than cut. The bottom line is ecosystem viability, underpinned by sustainable local economies. Achieving as much requires an organic, multi-faceted approach to conservation of the peninsula's 13 distinct ecosystems. Sound science provides the foundation for their efforts, the core of which includes establishment of a protected area network buttressed by community and government support.

By design, the network will connect to Corcovado National Park, crown jewel of the Costa Rica park system. Rugged and remote, at 100,000 acres (44,468 ha) Corcovado is not large enough to sustain wildlife that needs room to roam–e.g., jaguar (*Panther onca*), mountain lion (*Puma concolor*), herds of white-collared peccary (*Tayassu pecari*), and large forest raptors including harpy eagle (*Harpia harpyja*). The network, referred to as the Corcovado-Matapalo Biological Corridor, will effectively enlarge the park by creating an archipelago of protected land extending from the park to Cabo Matapalo, the rocky headlands at the southern tip of the peninsula. Tens of thousands of acres of vital neotropical migrant wintering habitat will be protected as a result.

Recognizing the substantial benefits to be realized by site protection, WDNR joined an alliance of international heavy hitters–Conservation International, The Nature Conservancy, the Gordon and Betty Moore Foundation, the Blue Moon Fund, the Beneficia Foundation and the American Bird Conservancy–to protect Cerro Osa.

Ultimately, Cerro Osa was spared domestication by bulldozer and became a key piece of the growing linkage to Corcovado. Just as important, for the first time in history, Wisconsin rallied to save important wintering habitat for its migratory birds, heralding a new era of bird conservation for our state. Cerro Osa represents not an end point, but rather the beginning of a long-term commitment to save our precious migratory heritage.

A Future for Our Birds

Protection of wintering grounds for neotropical migrants is gaining steam nationally. It is not merely coincidence that Southern Wings fledges at the same time Partners in Flight (PIF) celebrates 20 years of bird conservation. Indeed, Southern Wings has evolved from PIF's tireless efforts to expand the geography of bird conservation across North, Meso and South America. That is very good news for our migratory birds. But much remains to be done.

The magnitude of forest destruction in the tropics is staggering. The anticipated loss of remaining habitat due to expected population increases in Latin America over the next 40 years–100 to 360 million–casts an air of uncertainty over the region's surviving tropical forests and all species dependent on them, including our neotropical migrants.

Success will be predicated on implementation of habitat conservation strategies that span continents. Time is of the essence. As the clock ticks, trees fall and populations of many of our most beloved birds continue to decline. Their future is in our hands.

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Generation Next and Bird Conservation: "Always Connected" Continents, Disciplines and Communities

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All endeavor calls for the ability to tramp the last mile, shape the last plan, endure the last hours toil. The fight to the finish spirit is the one characteristic we must possess if we are to face the future as finishers.

Henry David Thoreau

Anniversaries offer an appropriate opportunity to pause and consider what lies ahead. As Partners in Flight (www.partnersinflight.org) celebrates its twentieth, we look to the future of this bird conservation initiative. Undoubtedly, Partners in Flight (PIF) will continue to be guided by our tripartite mission that has guided PIF to success: helping species at risk; keeping common birds common; and voluntary partnerships for birds, habitat and people. Yet, institutional, social, and environmental factors will cause us to adapt our approach to achieving this mission in order to succeed.

Any visioning for the future is best informed by the past, and PIF's rich history bestows much insight. The two observations that rallied the formation of PIF remain foundational to the initiative. In 1990, the central concerns were that populations of many birds, particularly Neotropical migrants, were in decline and that the current approach to conservation could not succeed without pooling resources and working cooperatively toward a common goal (Pashley et al. 2000). As its core, PIF continues to foster a collaborative approach, having proven again and again that the power of partnerships accomplishes bird conservation. Yet, through the years, PIF has expanded its emphasis in terms of birds and geography, and we continue to see the trajectory for inclusion and connections today. PIF has come to be concerned about Neotropical migrants *and* other landbirds. Further, an explicit shift to Western Hemisphere-centric approaches came after the Cape May, New Jersey workshop in 1995 (Pashley et al. 2000). In 1999, Partners in Flight – Mesoamerica Working Group (PIF-MESO) formed, which is now actively working in six countries in Central America, establishing regional and international bird conservation partnerships.

PIF has come to be known for its conservation assessments to determine which species are most in decline and how to reverse these trends (e.g., Rich et al. 2005, Berlanga et al. 2010). The latest assessment expands beyond Canada and the United States to Mexico and illustrates that many of the species at greatest risk of extinction in the Americas are actually endemic to the tropics, sharing their year-long residence with Neotropical migrants over-wintering (Berlanga et al. 2010). PIF aims to expand scope for conservation prioritization further and become more inclusive of nations throughout the hemisphere.

As the conservation field rapidly turns over its conservation leaders in this decade (Muth et al. 2002), a new generation of leaders will be at the helm to continue to promote PIF's mission and approach, while reacting to challenges, taking advantage of opportunities and learning from the leaders of today. From our perspective as young leaders in PIF, and hopefully those who will again be on stage for PIF's 40th anniversary in 2030—one the Chair of PIF's Education and Communications Working Group, the other representing the PIF-MESO regional coordinator—we offer our look into the proverbial crystal ball.

Challenges

Unquestionably, the next 20 years will present pronounced challenges for a new generation of conservation leaders. Global climate change, wrought with uncertainty about how vulnerability will play out, will continue to consume bird conservation as we aim to design effective adaptation and mitigation strategies. We suspect that changing climate will alter migration phenology, affect breeding performance and survival, modify distribution ranges, and threaten species with restricted habitat requirements, such as those reliant on high elevations, coasts and islands (Crick 2004, Butler and Taylor 2005, Wormworth and Mallon 2006). We will struggle to ensure that those species in greatest decline do not disappear. In our lifetime as young field biologists, we have already watched the Po'ouli (*Melamprosops phaeosoma*) become extinct in Hawaii. Native Hawaiian bird species are dramatically declining due to nonnative disease-carrying mosquitoes, loss of habitat, and feral nonnative mammals (NABCI 2009).

To the south, the loss of Neotropical habitats not only threatens the loss of resident and endemic bird species, but also lowers the overwinter survival rate of Neotropical migratory landbirds, causing high mortality and low breeding productivity in surviving birds (DeSante et al. 2006). Many other challenges have been identified as contributing to the declining abundance of Neotropical migratory birds, including loss of breeding habitat, habitat fragmentation, increased predation (DeGraaf and Rappole 1995) and collisions with man-made structures (Erickson et al. 2005). We will have to rise to additional conservation challenges from development, agriculture, energy production, invasive species and pollution (NABCI 2009).

Opportunities

PIF is committed to approaching the conservation of landbirds as an international resource with planning at a hemispheric scale (Rich et al. 2004). International engagement and coordination has been identified as a priority goal for bird conservation in all aspects of PIF's most recent Needs Assessment from the 4th International Workshop in McAllen, Texas—in education, outreach and communications (Dayer et al. 2009); research (Ruth and Rosenberg 2009); and monitoring (Laurent and Pashley 2009). PIF's recently released conservation assessment for Canada, Mexico and the United States, *Saving Our Shared Birds: A Tri-national Vision for Landbird Conservation,* aims to push the paradigm shift in bird conservation to thinking about our shared responsibility for all birds of North America and beyond, throughout their annual lifecycles (Berlanga et al. 2010). This approach contrasts the still-prevalent emphasis of bird conservation on birds within our political boundaries. The ultimate coordination of trans-boundary partnerships from the Arctic through South America will allow us to collectively address the challenges we face for the conservation of these shared species, while avoiding redundant effort and competing goals and objectives (Blancher et al. 2006).

While international collaboration and coordination will help address these conservation challenges, we would be naïve not to acknowledge additional challenges: lack of understanding of complex ecosystems, lack of trained professionals to meet the conservation challenges, lack of employment opportunities and adequate institutional arrangements at local levels, and land tenure conflicts and deprived socioeconomic conditions in many areas where conservation is essential (Santana 2005). In the next 20 years, we will work toward international bird conservation, with these challenges in mind, as outlined in *Saving Our Shared Birds*, protecting and recovering species at greatest risk; conserving habitats and ecosystem functions; reducing sources of direct mortality; increasing the power of partnerships; expanding our knowledge base for conservation; and engaging people in conservation action (Berlanga et al. 2010).

There are many examples of successful on-the-ground international partnerships established to meet bird conservation needs. PIF-MESO has become an important network for regional communications and coordination of bird conservation initiatives. PIF-MESO organizes and develops annual capacity building workshops in conjunction with the Mesoamerican Society for Biology and Conservation. PIF-MESO also fosters regional bird monitoring efforts, such as the Institute for Bird Population's Monitoring Overwinter Survival (MoSI) program (www.birdpop.org/MoSI/MoSI.htm), golden-cheeked warbler (*Dendroica chrysoparia*) and golden-winged warbler (*Vermivora chrysoptera)* monitoring efforts, and distribution of materials such as field guides, books and banding equipment. (Zolotoff 2006, Gutierrez and Juarez 2009). The MoSI Program has grown to involve more than 58 cooperating organizations and individual bird banders, including support from PIF and PIF-MESO, in Mexico, Central America, the Caribbean and Colombia (Saracco et al. 2009, Morales et al. 2006, DeSante et al. 2005). Alianza Alas Doradas (http://www.alasdoradas.org), the Non-Breeding Grounds Conservation Committee of the Golden-winged Warbler Working Group, is a partnership of 16 organizations and countless individuals working for the research, monitoring and conservation of golden-winged warblers (*Vermivora chrysoptera)* in the non-breeding grounds. El Grupo Ceruleo, the USDA Forest Service's *People, Wings, and Forests* program, Joint Ventures, Important Bird Areas, the Western Hemisphere Shorebird Reserve Network, the North American Bird Conservation Initiative (NABCI), and Southern Wings are just a few international programs working on the regional conservation of birds (Chester 2009, Capp 2005, Hahn 2008). PIF partners have played a leadership role in each of these, and we expect such efforts will continue to strengthen and proliferate, characterizing PIF.

While PIF currently emphasizes *landbird* conservation, PIF partners and spin-off projects from PIF increasingly emphasize *all birds*. When the North American Bird Conservation Initiative was formed in 1999 to bring together all of the bird conservation initiatives, it embraced PIF's approach of regionally based, biologically-driven and landscape-oriented partnerships (Pashley et al. 2000). Partnerships now transcend landbirds within this structure. Outside of the United States (e.g., Canada) and within specific states (e.g., Arizona), once landbird-focused PIF conservation initiatives have expanded to all birds. When PIF's conservation assessment process was undertaken in Mexico, ornithologists assessed the vulnerability of all Mexican bird species—not just landbirds (Berlanga et al. 2010). Furthermore, the State of the Birds effort (www.stateofthebirds.org), which PIF partners played an essential role in and builds on the PIF approach, employs all birds as indicators of environmental change and health in the United States (NABCI 2009). Similarly, the Bird Education Alliance for Conservation (www.birdedalliance.org) that serves as Partners in Flight's Education and

Communications Working Group was founded in 2007 on conservation education for all birds because most education and communications professionals do not focus on landbirds specifically. We expect that PIF efforts and projects will increasingly include more than landbirds.

Interdisciplinary and collaborative research—in the PIF spirit of partnerships—by biological and social scientists will aid us in prioritizing our needs for birds and people, and guide us in how to achieve them. Within the last few years, the importance of and need for social science related to bird conservation has become apparent to PIF. The Needs Assessment from the 4th International Workshop in McAllen, Texas included numerous needs for social science research (Ruth and Rosenberg 2009) and evaluation of education, outreach and communications (Dayer et al. 20009). Similarly, *Saving Our Shared Birds* highlights specific social science actions essential for tri-national landbird conservation, which are likely just as essential throughout the hemisphere (Berlanga et al 2010). We must prioritize understanding how and why various segments of people respond to birds and bird conservation, as well as linking social and ecological research related to critical bird conservation issues.

Such an acceptance of the essential nature of social science is being seen throughout wildlife conservation (Teel and Manfredo 2010). While the call for human dimensions (i.e., social science research related to natural resource management) began decades ago, Gill (1996) appropriately described the marginalization of human dimensions that still lingers in some fields and agencies today: the "crazy aunt" of the wildlife profession is hidden away in the basement because she is bizarre, unpredictable and difficult to deal with. A decade ago, Mortenson and Krannich (2001) found high acceptance for survey research and gathering of information about public opinion among state wildlife managers, but continued hesitance for more collaborative forms of public involvement. Calls for reform of wildlife conservation still do highlight the necessity for more multidisciplinary science, of which the discipline of social science is essential (Jacobson et al. 2010). Barriers to social science research, such as limited funding and marginalization within the wildlife conservation profession, must continue to be addressed and overcome in the future to allow for successful conservation in a society where human values toward wildlife are shifting (Teel and Manfredo 2010, Muth et al. 2002) and wildlife agencies face the need to rapidly reform to remain relevant and solvent (Jacobsen et al. 2010).

Similar to the social science emphasis on the importance of considering people in conservation, on-the-ground conservation educators and communications professionals must engage and activate a wider breadth of audiences to take appropriate actions for conservation. While PIF has always included education, outreach and communications, recently there has been an increased emphasis and energy around this integration. At the McAllen, Texas conference, there were an unprecedented number of sessions on education, outreach and communications. The conference chairs explained their emphasis on these areas at the conference: "Indeed, if we don't connect people—to each other, to the habitats, and to the birds—we cannot succeed, no matter how compelling our research, monitoring, and other scientific accomplishments" (Rich et al. 20009). Furthermore, the Needs Assessment conducted at the conference highlighted gaps in education, outreach and communications for conservation more than any other area (Dayer et al. 2009). As *Saving Our Shared Birds* outlines the needs for engaging people for tri-national bird conservation, they fall in four areas: implementing strategic education and communication goals in line with conservation priorities; building international capacity to meet shared education goals and share resources; engaging more bird enthusiasts in citizen science projects; and promoting the economic benefits of bird conservation and improving people's livelihoods through birds (Berlanga et al. 2010). We expect that these areas will be those where we make the most progress in the next two decades.

These areas of enhanced partnerships—transboundary, multidisciplinary and engaging people—will be possible due to technological innovation. Previously perceived challenges of distances and political boundaries will be minimized through unprecedented advancements in the field of information and communication technology, such as Wikis, web conferencing, online surveying and Skype. A recent PIF-MESO meeting in Belize had several attendees participating through Skype video conferencing, and a PIF-MESO electronic survey is circulating through the region. Blogs and social networking sites, such as YouTube, Facebook, LinkedIn and Twitter have grown exponentially among all demographics. By the end of 2009, users globally were spending nearly six hours each week on Facebook or Twitter (Boulton 2009).

Bird observatories, conservation NGOs, even local birding clubs are using the Internet and social networking to establish virtual communities and spread news and information about birds, science and conservation. Webcams at National Parks and at bird nests (e.g., Cornell's NestCams, watch.birds.cornell.edu/nestcams) bring intimate images of nature into homes and classrooms. To date, American Birding Association, American Bird Conservancy, National Audubon Society and BirdLife International have more than 1,500 followers each on Facebook. The benefits to members for meeting those with a similar passion for birds and bird conservation (Dayer 2009) and to organizations for connecting with a new audience are plentiful.

Furthermore, technology will allow for sharing of data, rapidly expanding our knowledge. From the first Internet-based data entry applications, such as National Audubon Society and Cornell Laboratory's Bird Source (www.birdsource.org; Dale 2005) created for Christmas Bird Count data, we now have an array of tools for data storing and sharing. From uploading personal trip lists or looking up species sightings on eBird (www.ebird.org) to visualizing a

project's banding data cross-analyzed with another through the Landbird Monitoring Network of the Americas (LaMNA) (www.klamathbird.org/lamna), professional biologists and birders alike have access to an unparalleled magnitude of data and information. Further, there are a variety of data-sharing platforms at regional (e.g., state and national eBird platforms) and global (e.g., BirdLife's Avibase, avibase.bsc-eoc.org, and Data Zone, www.birdlife.org/datazone/index.html) levels, which will continue to grow. For example, in seven years, eBird has gathered more than 21 million records from 1.6 million checklists and more than 35,000 unique users (Sullivan et al. 2009). The Avian Knowledge Network (http://www.avianknowledge.net) gathers bird records from hundreds of independent projects and individuals, and allows the archiving, visualizing and dissemination of observational data on birds to better understand their spatial and temporal patterns (Avian Knowledge Network 2009). The ease of information sharing that these new platforms provide will advance our knowledge of influences over avian distributions and improve the science and conservation of birds (Iliff et al. 2009).

Looking Forward

While our vision for the future is one where challenges become opportunities, we need the current generation of the conservation community to help prepare Generation Next as the conservation leaders of tomorrow—training us, mentoring us and allowing us space to explore new approaches to conservation. When PIF marks its 40th anniversary, Generation Next, those born in the late 1970s or early 1980s through the early 2000s, will be in their 30s through 50s and comprise the bulk of the conservation workforce. Generation Next shares values and attitudes shaped by growing up with technological innovations, cell phones, personal computers and the Internet (Pew Research Center 2007). We are accustomed to adopting technological innovations and communicating virtually. Furthermore, we comfortably approach conservation from a multi-disciplinary perspective, many having been trained in conservation programs that integrated ecological and social science (Muth et al. 2002). While value dissonance may occur as new and old conservation leaders come together (Muth et al. 2010), through an acceptance of the diversity of our views, approaches and abilities to reach old and new audiences for conservation, we will face the future of conservation together effectively. By supporting us, the young leaders who will forge new frontiers of partnerships, technology and action-orientation conservation, the long-term success of our partnerships and the sustainability of bird conservation initiatives will be ensured.

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Special Session Four.
What Does Green Really Mean? Renewable Energy Implications for Wildlife

Introductory Remarks

Rob Manes
The Nature Conservancy
Kanapolis, Kansas

John Emmerich
Wyoming Game and Fish Department
Cheyenne, Wyoming

We face great challenges as wildlife professionals in this era of climate change and renewable energy demand. In a world clamoring for responses to these challenges, there is a tendency to embrace any policy, science or fad that appears to offer promise. Unfortunately, the result of this rush is that we may implement climate change abatement measures and renewable energy strategies that do not deliver promised benefits and/or entail significant detriments to wildlife and other ecological assets.

Our opening comments will be brief, as we have a full slate of expert presenters who will help us examine the known and suspected threats that various renewable energy technologies pose to wildlife.

The synopsis of this session notes that an increasing national emphasis on renewable energy development is fueled, at least in part, by the assumption that renewable energy systems and practices entail little or no negative environmental impact. A significant and growing body of scientific evidence indicates that scientists and policymakers may be underestimating environmental consequences of some "green" energy initiatives. In light of the current policy and economic backing of renewable energy development, natural resource managers must understand not only the benefits but also the negative impacts these technologies pose to fish and wildlife populations and their habitats to inform best decisions.

Our expert presenters will examine effects of current and future renewable energy developments and discuss strategies to mitigate those effects. We will further address current policy and regulatory mechanisms driving the utility industry to invest in wind farms, biofuels production, solar facilities and geothermal plants.

The Natural Resource Planner--A Tool to Help Site Development Projects Minimize their Impact on Wildlife and Sensitive Habitats

Michael E. Houts
Kansas Biological Survey
Lawrence, Kansas

Eric R. Johnson
Kansas Department of Wildlife and Parks
Pratt, Kansas

Due to concerns about increasing energy costs, environmental issues of coal-fired utility plants, foreign versus domestic oil supply, and the subsequent concern of greenhouse gas emissions into the atmosphere, there has been a surge in efforts to explore and utilize renewable or "green" energy sources. Among the most prominent of these alternative energy sources (by both physical scale and public opinion) is the instillation of wind farms that utilize wind power to generate electricity. Wind turbines can effectively be installed pretty much anywhere wind energy potential exists, and the central portion of the United States represents some of the best wind power potential in the world (Lu et al. 2009). Kansas is located in the middle of a swath of 12 states that account for 90 percent of the potential wind energy from the conterminous United States and ranks third overall for wind energy potential (Elliott 1991). As a result of this massive wind energy potential, Kansas has received a great deal of interest from wind energy developers and investors to build large wind farms that take advantage of both the wind energy potential and the economic opportunities. There are numerous loan incentives, tax credits and development incentives for developers (Database of State Incentives for Renewable and Efficiency 2009), as well as the creation of local construction jobs and the long-term lease payments that help make the development of wind farms very attractive to many people. With all this potential for economic opportunity, it should be remembered that part of the driving force behind wind energy is its ability to generate electricity in an environmentally friendly way. Accordingly, there should be a way to make informed decisions based on both ecological and economical information to help site wind energy in locations that do not degrade wildlife habitat or other important natural resources, thereby nullifying the goal of generating "green" energy from wind farms.

The Kansas wind energy boom has led to the existing wind power capacity more than tripling since 2008, with five projects coming online in 2008 and 2009. As of January 1, 2010, there were seven active wind farms in Kansas producing a total of 1,016 megawatts, one under construction that would add another 12.5 megawatts, and approximately 44 proposals for new sites (Kansas Energy Information Network: http://www.kansasenergy.org/). The Kansas Department of Wildlife and Parks has reviewed more than 70 proposed wind energy projects since 2001, with 30 of these reviewed since 2008 (E. Johnson, Kansas Department of Wildlife and Parks, personal communication 2010). Currently, the lack of transmission is the primary limiting factor to wind energy development in central and western Kansas (where the greatest wind potential exists) and has limited where and how many wind farms are being constructed. Several high voltage transmission lines are currently proposed for construction in Kansas that would open the door for the many wind facilities currently limited by transmission capacity. The location of these new transmission lines will have a large impact on where the next wind farm development surge will occur and how the particular sites will be selected.

Kansas's Natural Landscape

In addition to the vast wind resource available, Kansas also contains vast grasslands that support livestock, a range of wildlife (both game and non-game species), and provide scenic natural areas for recreational activities. Among these grasslands in western Kansas are patches of short grass prairie sand prairie, and sandsage shrub land that represent critical habitat for the federal candidate and state petitioned lesser prairie chicken (*Tympanuchus pallidicinctus*). The eastern portion of Kansas, according to Küchler's (1974) potential vegetation, used to be almost completely covered by tall grass prairie except for riparian corridors and a few other exceptions. When compared with the 2005 land cover map of Kansas (Kansas Applied Remote Sensing Program 2009), the portion delineated by Küchler as bluestem prairie, is now 34 percent cropland, 15 percent introduced cool season grasses, 43 percent native warm season grasses (including 3 percent replanted as Conservation Reserve Program [CRP]), with the remaining 8 percent divided between urban, woodland, water and other cover classes. While Kansas has retained a sizable portion of the original grasslands, it is estimated that only approximately 29 percent of the pre-settlement grasslands remain in the United States (Loveland and Hutchinson 1995). The intense conversion of grasslands to cropland and the introduction of non-native grass species for pastures have created a highly fragmented ecosystem that has changed the plant and animal community composition and impacted the primary productivity (Gibson et al. 1993, Briggs and Knapp 1995, Collins and Steinauer 1998).

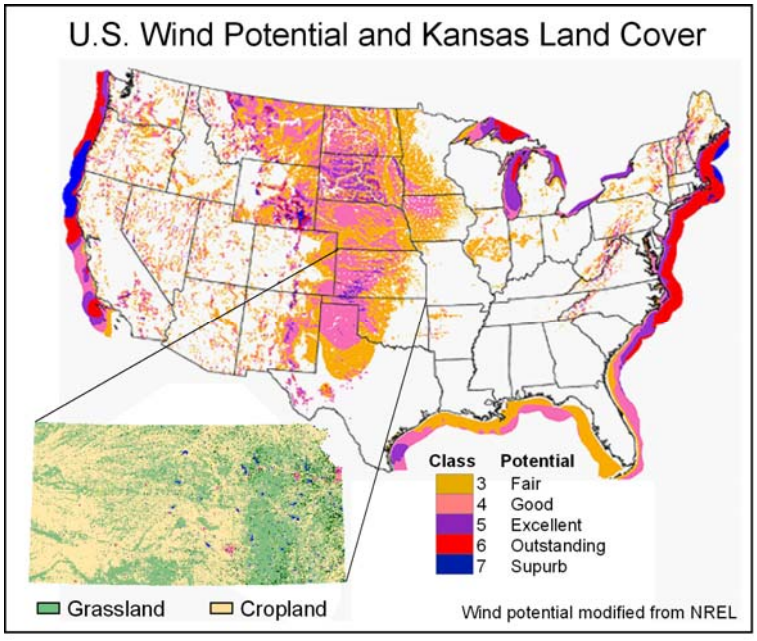
Additionally, the native warm season grasses of the Great Plains, particularly the tall grass species, have substantially higher water use efficiencies and can absorb and fix more carbon dioxide than their cool season counterparts (Knapp 1993, Tieszen et al. 1997). As more land-use change occurs, and grasslands become more fragmented and influenced by non-native species, the risk of severely altering the biological composition and ecosystem function of grasslands in the Great Plains increases. This shift in ecosystem structure and function could potentially move concerns of fragmentation from just wildlife habitat to the bigger issue of carbon sequestration and climate change.

Depressions in the landscape that capture and hold water (even temporarily) create a unique environment of wetlands that are important to a large number of land, water and avian species. The Quivira National Wildlife Refuge and Cheyenne Bottoms Wildlife Area are two of the largest wetland complexes in Kansas, and both are included on the Ramsar List of Wetlands of International Importance. Being located in the middle of Kansas also places these wetlands in the middle of the Central Flyway, and as a result, they host millions of migratory birds each year. Additionally, the state and federally endangered whooping crane (*Grus Americana*) utilize these large wetlands as well as smaller playa wetlands as they migrate (Kansas Natural Heritage Inventory: http://www.ksnhi.ku.edu/). Playas are shallow, ephemeral wetlands that periodically fill from heavy rains and provide critical habitat for a wide variety of wildlife and plant species, including more than 185 avian species, 13 amphibian species, 37 mammal species and 124 aquatic invertebrate species (Haukos and Smith 2003). These small, but important wetland depressions are distributed across northern Texas, western Oklahoma, Kansas, Nebraska, and eastern New Mexico and Colorado and are a key component of a "stepping stone" habitat mosaic used by shorebirds during migration between the Arctic and South America (Skagen and Knopf 1993, Davis and Smith 1998).

When Wind and Wildlife Collide

Some of the best wind resources in the United States are in open grasslands of Kansas, unfortunately, these same grasslands also support a range of wildlife that could be at risk if commercial wind power facilities are built in sensitive locations (Figure 1). The ability of commercial wind power facilities to impact wildlife and habitat can be divided into direct and indirect impacts. Direct impacts are usually fairly easy to calculate as they include the amount of land physically impacted by the turbines, roads, power lines and other infrastructure. This exact area varies by project but has been generally reported to be between 0.7 to 1.0 acres per turbine, or 0.4 to 0.7 acres per megawatt (Strickland and Erickson 2004). Wildlife mortality is another direct impact that can be assessed. The death of birds and bats due to wind facilities have been well publicized (and contested), though the numbers and frequency of such deaths vary considerably (Arnett et al. 2008, Johnson 2004, Kerlinger 2004, Kunz 2004, Kunz et al. 2007). Mortality surveys are difficult because they are static estimates on particular sites, dates and conditions, making them prone to both temporal and spatial anomalies. Additionally, researchers need to account for samples that went undetected because of oversight or because scavengers moved and/or consumed the carcass.

Figure 1. Overview of how the U.S. wind potential and the Kansas land cover patterns have a large area of co-occurrence.



While the number of studies focused on direct impact is substantial, research on indirect impacts, especially behavioral avoidance, is in its infancy. Relatively recent studies suggest that both greater (*Tympanuchus cupido*) and lesser prairie chickens have been found to avoid areas of human disturbances such as roads, oil and natural gas wells, and electrical transmission lines (Leddy et al. 1999, Robel et al. 2004, Pitman et al. 2005). Pruett et al. (2009) found that prairie chickens avoided areas within 100 meters of transmission lines and roads, while similar yet larger avoidance distances of 785 meters from highways and 363 meters from transmission lines were observed by Pitman et al. (2005). With evidence like this to support that prairie chickens and sage grouse (*Centrocercus urophasianus*) do avoid disturbed areas, a number of state agencies and the U.S. Fish and Wildlife Service have created voluntary guidelines that suggest a buffer area around wind facilities.

When abundant resources, high demand, and sensitive wildlife and/or habitats converge, the results can be detrimental to projects, as additional studies and/or conflicts significantly increase project timelines and budgets. Similarly, as some developers rush to get projects established by shortening the environmental review process (which is possible since there are no or limited sighting requirements for wind farms) the environmental impacts could be substantial. It was thought that by creating a free online resource tool developers could be proactive in making informed sighting decisions, and the openly available data could help keep locals, resource managers and potential investors aware of what natural resource variables occurred around a given location. The Natural Resource Planner is a dynamic and non-regulatory sight assessment tool that is updated as necessary to keep it current and useful.

Methods

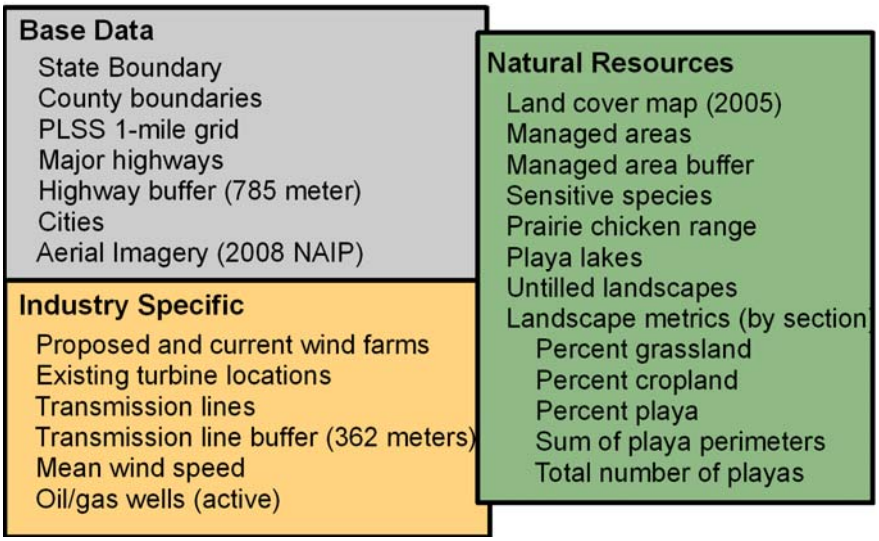
The Natural Resource Planner (NRP) began as a plan to create an interactive web mapping application that contained as much relevant and accurate information as possible so users could fully assess a wide range of variables for proactive site planning and assessment. GIS data were assessed and collected from three primary fields: 1) base data, 2) industry specific and (3) natural resource (Figure 1). Many of the data sets were obtained from the Kansas Geospatial Community Commons (KGCC), however, some were obtained from outside sources, and still others were either modified or generated internally. The data layers were processed and organized in ArcGIS 9.3 (ESRI 2008) with the goal of displaying all the data with intuitive symbology, while also keeping the layers visually separable if displayed at the same time. The map project was then imported into Arc Server.NET web ADF and the Natural Resource Planner web page was published online in September of 2008.

After the launch of the preliminary version, a panel of resource experts and potentially interested parties were invited to review and comment on the content and areas for improvement. Participants included representatives from the Kansas Department of Wildlife and Parks, Kansas Biological Survey, Kansas Applied Remote Sensing Program, The Nature Conservancy, Playa Lakes Joint Venture, University of Kansas, Kansas State University, Fort Hays State University, Emporia State University and a utility company representative. An early decision was made that the NRP provide scientific data on a wide range of variables and allow users to disregard information not relevant to them. It was thought that this option to include extra data would be better than 1) having relevant information missing if the NRP data was utilized for a different application, or 2) having a different set of data and maps for each type of application. Second, a consensus was reached that beyond the feature-specific data and categorical land cover/habitat type data, some quantitative metrics would be useful to help compare sites. The 1x1 mile public land survey system (township/range/section) was used to provide landscape analysis, since it was a mapping unit relevant to both wildlife managers and development projects. Within each 1x1 mile section, the area of grassland, cropland and CRP land was calculated and converted to a percentage. Similarly, playa lakes were summarized by section, and the total number of playas, the percentage of the section covered and the sum of the perimeters were calculated. These calculations were displayed to differentiate sections with low, moderate and high amounts of a certain variable, and provided a reference for comparisons, but these metrics stopped short of providing a threshold value for defining what constitutes significant area for habitat conservation or areas sensitive to development. The exact numbers were available for a more detailed comparison by quarrying the Public Land Survey System Landscape Summary layer (Figure 2).

As part of the web-mapping application, there are the familiar tools for zooming in/out, panning, quarrying and measuring, but additional links were placed at the top for users to access additional information. A “User Guide” is available to provide a detailed review of the tools, functionality and the purpose of the NRP. There is a metadata document titled “About NRP” that provides a user-friendly narrative about the data layers in the NRP and the processing history. Users can also investigate “Additional Resources” to link to a web page populated with links to relevant web sites, a growing library of papers on wind and/or wildlife that can be downloaded or .pdf posters of the NRP. Finally, by utilizing the “View in ArcMap” option, users can also download an ArcGIS layer file (.lyr) that can be added into an

existing in-house ArcGIS project. This layer file will automatically link with all of the data layers on the website and bring the data into a GIS project so users can see their data in relation to the NRP data layers.

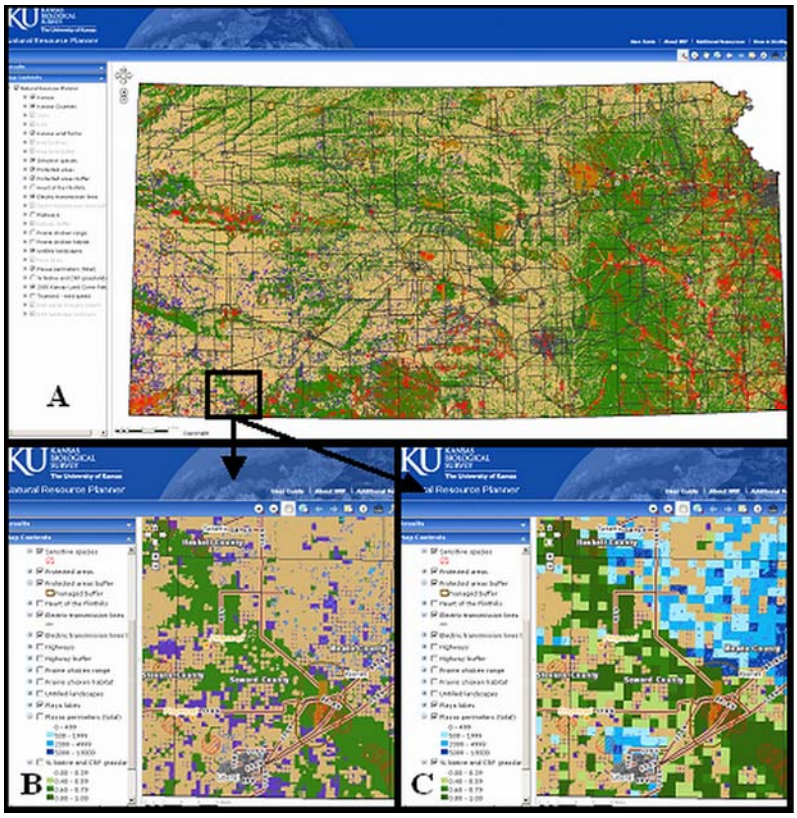
Figure 2. A list of the data layers present in the Natural Resource Planner application sorted by theme.



Data Layers in the NRP

The processing that was performed on the individual data layers varied considerably, but the following description provides a summary of the processing for some of the more prominent data layers in the NRP (Figure 3)

Figure 3. Screen views of the Natural Resource Planner showing: A) statewide overview depicting grasslands (green), CRP (purple), cropland (tan), sensitive species (red) and transmission lines (black); B) closer view of a portion of southwestern Kansas showing more detail; and C) same southwestern area, with percentages of grassland (greens) and total playa perimeter (blues) per PLSS section.



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Wind farm information was derived from data obtained from the Kansas Energy Information Network and applications to connect to the Southwest Power Pool. Using hardcopy maps, site descriptions and other contextual information (mean wind speed, existing power lines and highways), the approximate proposed location was digitized. For existing wind farms, the exact turbine locations were digitized by identifying them on high resolution National Aerial Imaging Program (NAIP) imagery from the spring of 2008.

The **managed areas** data layer started from a dataset on KGCC regarding land stewardship that identified public and private areas. The layer was modified by adding conservation easements obtained from The Nature Conservancy and the Kansas Land Trust, and a buffer was created to extend beyond the actual managed area (excluding private conservation easements) to help indicate that a conservation area was nearby. Through discussions with contributing partners, it was decided that a two-mile buffer around wildlife and conservation areas would be an appropriate distance. An exception to this buffer distance was made for the Cheyenne Bottoms Wildlife Area and the nearby Quivera National Wildlife Refuge, both of which are recognized as Ramsar Wetlands of International Importance. Each of these areas received a 10-mile buffer, which resulted in the two buffers intersecting and thereby keeping them functionally connected.

Sensitive species data started from a geospatial database of species available on KGCC compiled by the Natural Heritage Program that contained 5,332 locations for 635 species. The database provided polygon locations (approximately one mile in area) that identified the general location of the species to assist planners while also protecting their exact location from the general public. This geospatial database was modified to include only species listed as threatened or endangered (state or national) plus three additional species (little blue heron [*Egretta caerulea*], Texas horned lizard [*Phrynosoma cornutum*] and lesser prairie chickens) that were identified as Species of Greatest Conservation Need in A Future for Kansas Wildlife, Kansas' Comprehensive Wildlife Conservation Strategy (Wasson et al. 2005). An additional polygon was later added to indicate a 15-mile buffer around a cluster of terrestrial caves in southcentral Kansas that were known to be important bat habitat. The new layer of sensitive species contained 2,443 polygons for 125 species.

While **prairie chickens** are not the only species potentially affected by natural resource development in Kansas, the lesser prairie chickens' status as a candidate for the threatened species list coupled with their documented aversion to anthropogenic features made their inclusion in the NRP an easy decision. The general range of prairie chickens as delineated by expert opinion (Houts et al. 2008) was obtained from the KGCC and included. To provide a more detailed reference to what may actually be usable prairie chicken habitat both inside and outside their current range, the potential prairie chicken habitat layer was also included. The potential habitat layer was created from warm season C4 grasslands and CRP data from the 2005 Kansas land cover map (Kansas Applied Remote Sensing Program 2009). Buffered areas around highways (2,575 feet: 785 m), transmission lines greater than 345 kV (1,191 feet: 363 m) and woodlands (656 feet: 200 m) were created and then removed from the grass and CRP layer. As a final step, polygons less than 80 acres (32.4 ha) were removed, to leave only grasslands that were away from roads, transmission lines and trees and greater than 80 acres (32.4 ha) as potential habitat.

Playas are shallow seasonal wetlands that support a wide variety of plant, mammal and bird species. In addition to being an important wetland habitat, the water captured in the playas also represents a primary source of recharge for the Ogallala aquifer. An updated map of playas in Kansas was recently completed by Johnson et al. (2008) after visually scanning multiple years of high-resolution aerial photography and manually digitizing the playa perimeters. The 22,045 playas identified covering 81,375 acres (min 0.08, max 464, mean 3.7) (32,932 ha) are not always wet, and in the dry season/years, they are often utilized as cropland. Identifying an ecologically important measurement for playas (surface area, shoreline length, nearest neighbor) proved to be a daunting task that was made even more difficult by the fact that they are only utilized intermittently when wet. The Playa Lakes Joint Venture is in the final stages of creating a two-tier assessment and ranking of playas. The first method ranks individual playas based on their size and surrounding land cover type, and connectivity (with larger playas, playas in grasslands and clusters of playas ranking highest). The second approach focused specifically on ranking playa clusters, and utilized kernel density to assess clusters by both total area and by playa frequency (Mclachlan 2010).

To provide a **landscape summary** of the variables present and a quantitative assessment of the land cover, the PLSS one-mile grid was intersected with all the variable layers. The presence or absence of each variable was then added to the attribute table of the PLSS grid. Additionally, summary statistics were calculated on the 2005 land cover map to calculate the percentage of all grasslands, warm season (non-CRP), CRP and cropland present within each section.

A variety of **background layers** and base data were added to help users put the natural resource data in context. Background layers included the 2005 land cover map for Kansas, the mean annual wind speed, and 6.56-foot (2 m) resolution NAIP imagery from 2008. The mean annual wind speed at 328 feet (100 m) above ground for Kansas was generated by AWS Truewind using the MesoMap system and subsequently obtained for this project via the Kansas Corporation Commission. Due to the combination of the commercial value of the data and the interest in serving it over the internet, the data was resampled from its original 656-foot (200 m) resolution to a 3.28-foot (1.0 km) resolution. Additionally, roads, highways and electrical transmission corridors were added.

Results

After numerous meetings and revisions, the NRP emerged as a successful assemblage of data that integrated GIS data layers into a web-based mapping environment so users could customize their viewing parameters. When first launched in September 2008, the website was announced to potential users at the Kansas Wind and Renewable Energy Conference in Topeka later that month. Since web page viewing statistics began being logged on August 28, 2009, there have been consistently about 500 viewers per month. Of these users, 14 percent were repeat users and 86 percent were new to the site. While we were not able to directly track who the major users were, it is known that the NRP site was accessed most via a link on the Kansas Information and Energy Network and by people typing in the html address directly. The average time spent at the site was almost five minutes, indicating that users found the site and information useful enough to stay and utilize it. Additionally, there have been several reports of the NRP being used as a resource for site assessment by developers as well as by resource professionals requested to inspect sites for project suitability, further supporting the conclusion that the data and the site are a useful resource.

Discussion

With the goal of providing relevant and accurate information, the NRP website is not a one-time static map. The content of the NRP page is updated as necessary to provide the best data possible, and as scientists identify significant wildlife/habitat relationships, those parameters will be added. Efforts are also being made to make the page more functional for public users, with possible updates including the addition of a mapping template for creating custom maps and a process by which users could upload a polygon and have the NRP generate a report of the variables intersected. There are also efforts being made by interested third parties to utilize the data in the NRP to develop a quantifiable ranking that approximates the “ecological importance” of a location to help identify conservation priority areas and/or natural areas that could be damaged by development projects. If successful, these measures could be used to help site projects and as a basis for a type of eco-labeling or green certification that indicates a project has met certain environmental criteria.

While already used by many in the wind development industry, the NRP gained additional momentum after it was presented to some members of the Kansas legislature and several state agencies to demonstrate its functionality and value to a wide range of potential applications. Following the meeting, interest was shown by those in attendance to utilize the NRP and to participate in future plans and updates. Additionally, the Kansas Department of Wildlife and Parks is continuing to support the NRP through additional data development and the creation of a Decision Support System that will utilize data from within the NRP to analyze a project’s potential impact and then display the results on the NRP.

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Impacts of Energy Development on Prairie Grouse Ecology: A Research Synthesis

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As demand has increased for energy resources in recent years (National Petroleum Council 2007), both U.S. federal and state governments have established renewable energy quotas for their energy portfolios (Lu et al. 2009). These quotas are targeted to diversify sources of energy generation and offset the myriad risks associated with climate change. The geographic location of renewable energy sources (e.g., wind, geothermal or bio-mass) has potential to open new markets for generation and transmission of electricity in portions of the U.S. that have not previously been developed for such industrial use (Green and Nix 2006, Lu et al. 2009). The tall and mixed-grass prairies of the Midwest, and sagebrush (*Artemisia* spp.) steppe of the Intermountain West and Great Basin host some of best wind resources in the continental U.S. (Lu et al. 2009). A considerable portion of the Great Basin has significant potential for geothermal energy development (Green and Nix 2006). Much of these native habitats have been lost since European settlement, with reductions of 60 and 70 percent, of sagebrush and prairie types, respectively (Samson et al. 2004, Schroeder et al. 2004).

The remaining native habitats in both of these biomes are home to the iconic prairie grouse species, including greater (*Centrocercus urophasianus*) and Gunnison's sage-grouse (*C. minimus*), greater (*Tympanuchus cupido*) and lesser prairie-chicken (*T. pallidicinctus*), and sharp-tailed grouse (*T. phasianellus*). All of these species require healthy native habitats and generally occupy large landscapes. Because of their dependence on native rangelands and strong site fidelity, the historic loss and degradation of these habitats has led to reduced distributions and in some cases long-term declines in populations of prairie grouse. Thus, the lesser prairie-chicken and both species of sage-grouse are candidates for protection under the Federal Endangered Species Act (www.fws.gov/mountain-prairie/species/birds; accessed 28 February 2009).

Collectively, these endemic game birds often are indicators of ecosystem health for the suite of other avian and mammalian species that occupy these vast regions (Rowland et al. 2005, Hanser and Knick *in press*). There are myriad stressors on these systems: from recreational use to type-conversion for agriculture or industrial uses. Any of these land uses may directly reduce habitat quality or indirectly affect habitat use or demography through avoidance of highly disturbed sites or increased predation rates, respectively (Fuhlendorf et al. 2002, Aldridge and Boyce 2007, Hagen et al. in press, Leu et al. in press). Given projected energy demands and new quotas for energy development portfolios, there is potential risk to significantly reduce and fragment the remaining habitats (Doherty et al. in press, Leu et al in press). However, few data exist regarding the impacts of wind energy development on prairie grouse, and much of the inference on development comes from existing transmission corridors or fossil fuel extraction. Collectively, the body of literature on anthropogenic features and prairie grouse suggests there are negative consequences to populations with this type of development (Robel et al. 2004, Naugle et al. in press). A data synthesis has not been conducted to estimate the generalized effect size of anthropogenic features on prairie grouse space use or demography. Elucidating and quantifying a generalized effect can provide important guidance to conservation efforts (Hagen et al. 2007). Current conservation strategies seek to avoid, minimize or mitigate these impacts on a project-by-project basis, and maintaining sustainable populations using such an approach has been questioned (Doherty et al. in press).

The objectives of this paper are to 1) synthesize current data on the impacts of energy development (and associated infrastructure) on prairie grouse distribution and demography; 2) identify potential mechanisms for population-level responses; 3) address potential future impact to populations; and 4) recommend a conservation strategy for large landscapes to increase the certainty of population persistence of these iconic species.

Methods

I searched peer-refereed articles, graduate research theses and non-refereed reports that pertained to prairie grouse and the impacts of energy development. Because there is a lack of published information on prairie grouse and wind energy development, I chose to include data from two non-peer refereed studies (including three species) on this topic (Young et al. 2003, Vodenhal 2009). Most studies reported several demographic rates or displacement (e.g., distances from features) variables, some of which were non-independent (e.g., brood survival and productivity ratios), in such cases, I chose only one of those variables to include for estimates of effect size. In all cases, each demographic rate was independent from others and treated as a significant unit (e.g., nest initiation rate, nest success). The strength of a meta-analytic approach is that it uses a standardized metric (similar to the coefficient of variation) and enables comparisons

within and among studies that measured different aspects of a population's demography (Hedges and Olkin 1985, Gurevitch and Hedges 1999, Hagen et al. 2007).

Data Analysis

A general equation for an effect size (*d*) of a single study is the treatment mean minus control mean divided by the pooled variance (Hedges 1982). The effect size for each independent variable in a study serves as a dependent variable that can be modeled as a function of discrete or continuous explanatory variables or used to estimate a cumulative effect size (d_{++}) across multiple studies. As a general guideline, effect size magnitude can be ranked as small (0.2), medium (0.5) or large (0.8) standard deviations from a null effect size of zero (Cohen 1969).

I used Hedges' *d* because it is conducive to estimating an effect between paired treatments or observational groups, and estimated cumulative effect size d_{++} for each demographic and displacement effect (Hedges 1982). I used pre-construction, reference sites, areas of less disturbance (where there was a gradient of development levels) areas outside of development buffers and control sites, to collectively define the "control" group. I used post-construction sites, areas of greater disturbance (where there was a gradient of development levels), and areas inside of development buffers collectively to define the "treatment" group; thus, a positive estimate of *d* and 95-percent confidence intervals (CIs) non-inclusive of zero indicated a distance or demographic variable was positively influenced (benefited) by energy development. Whereas a negative estimate of *d* and 95-percent CIs non-inclusive of zero indicated a distance (hereafter displacement) or demographic variable was negatively influenced by energy development, and any estimate of *d* with 95-percent CIs that included zero no measurable effect could be inferred.

I chose bias corrected bootstrap sampling to estimate 95-percent CIs for d_{++}, to account for replicate years, areas or multiple variables being measured within studies. I evaluated the plausibility of using additional explanatory variables to explain the observed differences in effect sizes among studies. I used mixed models to identify a common effect size (or lack thereof) across species, studies and seasons (categorical data) for each demographic or displacement effect. The basic assumption for this analysis is that random variation occurs among effect sizes within a species (or study site), but may differ between them (Gurevitch and Hedges 1999). Here, the statistic Q_B can be used to assess the amount of variation in effect sizes accounted for between groups. If Q_B is greater than would be expected at random (χ^2 - distribution) it suggests that effect sizes are larger between groups than expected from random. If Q_B was non-significant, then a random effects model was used to estimate a cumulative effect size for each demographic or displacement effect for all studies and species. All meta-analytic calculations were conducted in MetaWin 2.0 (Rosenberg et al. 2000).

The quality of a research synthesis hinges on the quality of publications available to analyze, as well as studies not published because of a lack of significant results (Rosenberg 2005). Such bias is referred to as publication bias and can overestimate the effect size if a large number of non-significant studies are not published or accessible. The preferred method to evaluate the potential impact of publication bias is the calculation of a fail-safe number (N_+; Rosenberg 2005). A fail-safe number indicates the number of nonsignificant, unpublished (or missing) studies that would need to be added to a meta-analysis to reduce an overall statistically significant observed result to non-significance (Rosenberg 2005). The limitation to this approach is there is no fail-safe number for mixed model estimates. I estimated fail-safe numbers for each significant effect size using Fail-Safe Number Calculator (Rosenberg 2005), and considered an effect size robust if $N_+ > 5N + 10$, where N is the observed number of studies used to estimate the effect size. Because I used mixed models to estimate effect sizes, I report fail-safe numbers for both fixed and random effects models.

Results

I located 22 studies (13 peer-refereed, 5 graduate studies and 3 non-refereed reports) that reported quantitative data on prairie grouse responses to energy development (Table 1). Four studies did not report data in a format that could be used for a meta-analysis using Hedges' *d* (Braun et al. 2002, Aldridge and Boyce 2007, Doherty et al. 2008, Pruett et al. 2009), and two others were synthesis papers that did not report original data (Robel et al. 2004, Naugle et al. in press). One article on the European black grouse (*Tetrao tetrix*) was included as it directly measured the impacts of wind farm development on lek attendance (Zeiler et al. 2009). Black grouse occupy a similar niche to that of the Columbian sharp-tailed grouse (*Tympanuchs phasianellus columbianus*), using montane shrub communities but also occupying wooded or forested habitats. Five studies provided information on displacement distances to 6 types of features resulting in 26 estimates of *d* (Table 1). Thirteen studies provided estimates of demographic rates as they related to development resulting in 41 estimates of *d.*

Table 1. Studies reviewed and included in a meta-anlysis examining the displacement and demographic effects of energy development on prairie grouse species.

Study	Species[a]	Development type[b]	Design[c]	Displacement[d]	Demography	Report
Aldridge and Boyce 2007	GRSG	OG	GR	Y	Y	Peer refereed
Braun et al. 2002	GRSG	OG	GR	N	Y	Peer refereed
Doherty et al. 2008	GRSG	NG	GR	Y	N	Peer refereed
Ellis 1984	GRSG	PL	TC	Y	Y	Peer refereed
Hagen et al. 2009	LPCH	DV	OR	Y	N	Peer refereed
Holloran 2005	GRSG	NG	TC	Y	Y	Thesis
Holloran et al. 2007	GRSG	NG	TC	Y	Y	Report
Holloran et al. 2010	GRSG	NG	TC	Y	Y	Peer refereed
Hunt 2004	LPCH	OG	PP	Y	N	Thesis
Johnson et al. in press	GRSG	DV	GR	Y	Y	Peer refereed
Kaiser 2006	GRSG	NG	BF	Y	Y	Thesis
Lyon and Anderson 2003	GRSG	NG	TC	Y	Y	Peer refereed
Pitman et al. 2005	LPCH	DV	OR	Y	N	Peer refereed
Pruett et al. 2009	LPCH, GPCH	PL, RD	OR	Y	N	Peer refereed
Robel et al. 2004	LPCH	DV	OR	Y	N	Peer refereed
Tack 2010	GRSG	OG	GR	Y	Y	Thesis
Vodenhal 2009	SHTG, GPCH	WD	OB	N	Y	Report
Walker et al. 2007	GRSG	NG	TC	Y	Y	Peer refereed
Williamson 2009	SHTG	OG	TC	N	Y	Thesis
Young et al. 2003	GRSG	WD	PP	Y	N	Report
Zeiler and Berger 2009	BLGR	WD	PP	Y	Y	Peer refereed

[a] Grouse species include: greater sage-grouse (GRSG), greater prairie-chicken (GPCH), lesser prairie-chicken (LPCH), sharp-tailed grouse (SHTG) and black grouse (BLGR).
[b] Development type includes: oil/gas (OG), multiple forms of development (DV), wind energy (WD), natural gas (NG), power lines (PL) and roads (RD).
[c] Study design generally characterized as pre- and post construction (PP), treatment and control sites (TC), observed compared to random (OB), distance gradients using regression (GR), and impacts compared inside and outside of development buffer (BF).
[d] Type of data reported in an article, displacement or habitat use, or demography, indicated by a yes (Y) or no (N).

Effect Sizes

There was a general effect for prairie grouse displacement by anthropogenic features (d_{++} = –0.671, 95 percent CI: –1.105, –0.341). An examination of Q_B indicated that the effect (d) of anthropogenic features was similar among studies (P > 0.199), species (P = 0.124) and seasons (P = 0.406) for each variable (Table 2). The mixed model examining the similarity of effect sizes among features indicated there was measurable heterogeneity among classes of features (P = 0.020). However, features only measured in one study were not included in this model, because at least two effect sizes are needed to define a class in the mixed-model analysis. Thus, I evaluated an overall random effects model which included data from all studies that measured distances to anthropogenic features, and the overall model indicated that drawing inference from an average effect size was reasonable (P = 0.433). Anthropogenic features had a negative effect on displacement in all biological seasons for which d could be estimated (Table 2), with the largest effect on nesting season (d = –1.026, 95 percent CI: –1.889, –0.307). The presence of power lines had the largest measurable effect on displacement (d = –1.526, 95 percent CI: –2.052, –0.974), followed by roads (d = –0.736, 95 percent CI: –1.867, –0.126).

Demographic rates were generally reduced by energy development (d_{++} = –0.303, 95 percent CI: –0.609, –0.064). An examination of Q_B indicated that the effect (d) of anthropogenic features was similar among studies (P = 0.115), species (P = 0.288), features (P = 0.216) and seasons (P = 0.540), for each variable (Table 3). Demographic rates were lower in developed areas for all biological seasons for which d could be estimated (Table 3), with the largest effect on annual survival (d = –0.523, 95 percent CI: –1.042, –0.250). Buffer areas around natural gas wells and turbines had the largest two effect size estimates, but neither was precise enough to conclude a measurable effect. Only gas fields had a measurable effect on demography of prairie grouse. However, per the Q_B test, drawing inference from the overall random effects model Q_T (P = 0.712) was reasonable and indicated a small to moderate negative effect (Table 3).

Table 2. Effect size estimates (*d*) and 95-percent CI for displacement of prairie grouse by anthropogenic features from five studies, and diagnostic statistics (Q_T, N_+) from mixed model meta-analyses. Mixed models were used to explore potential relationships between features, and biological season, even though a generalized random model (Overall) did not detect heterogeneity in effect sizes among features or seasons. An asterisk indicates a fail-safe number (N_+) is robust (>5*N* + 10). The fail-safe number is equivalent to the number of studies of null effect and mean weight necessary to reduce the observed significance level to $\alpha = 0.05$.

	Parameter estimates			Diagnostics	
Feature	N	*d*	95-percent CI	Fail-safe (N_+) fixed effects	Fail-safe (N_+) random effects
Power lines	6	–1.526	–2.052, –0.974	1,936*	1
Wells	6	–0.299	–0.652, –0.046	75*	1
Buildings	4	–0.169	–0.500, 0.109	NA	NA
Roads	6	–0.736	–1.867, –0.126	198*	1
Total[a]	22	–0.724	–1.160, –0.372	Non-est	Non-est
Season					
Lekking	2	–0.066	–0.131, 0.015	NA	NA
Nesting	9	–1.027	–1.915, –0.263	1,335*	1
Brood	3	–0.209	–0.311, –0.058	1	1
Annual	10	–0.591	–0.925, –0.273	773*	1
Total[a]	24	–0.671	–1.065, –0.348	Non-est	Non-est
Overall[a]	24	–0.671	–1.065, –0.348	4,801*	1

[a] Diagnostics for mixed model of feature type $Q_T = 34.17$ df = 21 $P = 0.03$; season of use and random effects model included all studies $Q_T = 22.48$ df = 23 $P = 0.49$.

Table 3. Effect size estimates (*d*) and 95-percent CI for demographic impacts of prairie grouse by anthropogenic features from 13 studies, and diagnostic statistics (Q_T, N_+) from mixed model meta-analyses. Mixed models were used to explore potential relationships between features, and biological season, even though a generalized random model (Overall) did not detect heterogeneity in effect sizes among features or seasons. An asterisk indicates a fail-safe number (N_+) is robust (>5*N* + 10). The fail-safe number is equivalent to the number of studies of null effect and mean weight necessary to reduce the observed significance level to $\alpha = 0.05$.

	Parameter estimates			Diagnostics	
Feature	N	*d*	95-percent CI	Fail-safe (N_+) fixed effects	Fail-safe (N_+) random effects
Wells	2	–0.280	–0.560, 0.000	NA	NA
Gas Field	21	–0.202	–0.415, –0.003	84*	1
Turbine	4	–0.774	–1.543, 0.027	258*	NA
Buffered dis.	4	–0.736	–1.967, 0.187	17	1
Total[a]	31	–0.347	–0.620, –0.116	Non-est	Non-est
Season					
Lekking	10	–0.097	–0.467, 0.269	NA	NA
Nesting	5	–0.432	–2.095, 0.521	NA	NA
Brood	10	–0.104	–0.246, 0.029	NA	NA
Annual	6	–0.573	–1.035, –0.250	42	1

Table 3 continued

Total[a]	31	–0.246	–0.558, –0.028	Non-est	Non-est
Overall[a]	32	–0.303	–0.557, –0.073	1,512*	1

[a] Diagnostics for mixed model of feature type Q_T = 35.94 df = 30 P = 0.21; season of use Q_T = 33.79 df = 30 P = 0.29; and for random effects model across all studies Q_T = 26.17 df = 31 P = 0.71.

Publication Bias

The relatively small number of studies included in these analyses resulted in fail-safe calculations under a random-effects model indicated that only one additional study was needed to reduce the observed effect sizes to a non-significant level under the random-effects model. However, estimating fail-safe calculations under the assumption of fixed effects, most estimates of d and d_{++} were robust to publication bias (Tables 2 and 3). Given the extreme differences in these outcomes, it is likely that truth is somewhere in the middle of these two estimates.

Discussion

I provide the first quantitative assessment of available data on the impacts of anthropogenic features on displacement and demography of prairie grouse. I found a general effect for displacement and reduced demographic rates, as evidenced by low levels of variation in effect sizes across studies and species. Most of the effect size estimates were not robust to the potential impacts of publication bias, suggesting additional research is needed to better understand biological mechanisms underlying these patterns. Notwithstanding, the best available data indicates moderate to large displacement effects and small to moderate demographic effects on prairie grouse populations. Together, these effect size estimates add to the growing body of evidence indicating that anthropogenic features displace and may reduce demographic rates in prairie grouse species. However, limitations of these generalized impacts should be addressed. There were relatively few studies from which to draw data, and as a result, multiple measurements from a single study were often included and assumed to be independent data points. Nevertheless, I included only those variables (or estimates) that were independent of one another (e.g., nest initiation, nest success, brood survival, annual survival) to avoid overestimating an effect size and to minimize underestimating variances. Similarly, distances and displacement data relative to features were drawn from a relatively small set of studies, and some of those measurements may have been correlated. However, I had no way of determining the level of correlation and had to assume they were independent measures. Ideally, as the impact-study body of literature grows, these meta-analytic techniques can be directed at questions regarding specific demographic rates and specific types of development or anthropogenic features.

Overall, the displacement effect size of anthropogenic features on prairie grouse space use was nearly one standard deviation (–0.7) and would be considered a medium to large effect (Cohen 1969). The displacement effect varied by feature type; power lines and roads had the largest effects. However, recent work in the oil and gas fields that used regression techniques further supports the levels of displacement by gas field development synthesized in my study (Holloran 2005, Walker et al. 2007, Doherty et al. 2008, Holloran et al. 2010, Tack 2010).

Regression analyses and Monte Carlo simulations have identified distance thresholds of avoidance as well as demographic responses to energy development. Avoidance of energy development for greater sage-grouse can occur out to approximately 3.1 miles (5 km) for nesting and lekking (Holloran 2005, Johnson et al. in press). Both species of prairie chicken appear to be more tolerant of these disturbances with minimum distances of less than 1.1 mile (1.8 km) in many cases (Pitman et al. 2005, Pruett et al. 2009, Hagen et al. in press). However, Hagen et al. (*in press*) caution that the apparent tolerance to these features may represent populations occupying habitat sinks (Aldridge and Boyce 2007, Hagen et al. 2009). Simple distances to features is not always the best indicator of avoidance (Holloran 2005), and elucidating the patterns of habitat use relative to the density of features can be more informative. The density of oil, natural gas and coal-bed methane gas infrastructure was negatively correlated with nest locations, winter habitat use, lek attendance and number of active leks (Hunt 2004, Holloran 2005, Walker et al. 2007, Doherty et al. 2008, Tack 2010).

Presence of anthropogenic features tended to negatively affect prairie grouse demographic rates (–0.3), and would be considered a small to moderate effect size (Cohen 1969). The 95-percent CIs for largest point estimates of d (turbines and gas field buffers) both overlapped zero. Thus, the presence of turbines relative to black grouse leks and demographic rates of greater sage-grouse inside a 6-kilometer buffer of natural gas fields were the factors behind these effect size estimates. Seasonal variation in demographic effects was not measurable, but an exploratory examination of those results indicated that the largest effects were to annual survival and nesting season rates (e.g., nest initiation, nest success).

However, the effect on nesting season rates (d = –0.4) was not measurably different from zero, but the effect on annual survival was moderate (d = –0.5).

Female prairie grouse are capable of successfully hatching nests despite various levels of development (Lyon and Anderson 2003, Pitman et al. 2005, Kaiser 2006, Williamson 2009). The impacts on nest initiation rates and brood survival are more variable, with sharp-tailed grouse demography seemingly the least affected based on a two-year study (Williamson 2009). Reduced chick survival and annual survival have been documented in greater sage-grouse occupying energy development sites (Ellis 1985, Kaiser 2006, Aldridge and Boyce 2007, Holloran et al. 2010). A portion of the increased mortality can be attributed to predation and vehicle collisions (Ellis 1984, Aldridge and Boyce 2007). Chick survival and adult female survival are generally the drivers in population dynamics of prairie grouse, and reductions to these rates may have population level effect (Wisdom and Mills 1997, Johnson and Braun 1999, Holloran 2005, Hagen et al. 2009, Walker et al. in press).

Lek attendance and persistence were variable with respect to energy development (Walker et al. 2007, Vodenhal 2009, Johnson et al. in press). The two examples of lek attendance relative to wind energy development demonstrate this variation. Zeiler and Grunschnacher-Berger (2009) documented the local displacement and near extirpation (from preconstruction counts) of black grouse display grounds in the vicinity of a 13-turbine wind farm over an eight-year period. In contrast, greater prairie-chicken and sharp-tailed grouse continued to display at leks in an area with 36 turbines four years post construction (Vodenhal 2009). Unfortunately, there were no preconstruction data to allow comparisons of population trends (or distributions) to the larger region pre- and post construction, but greater prairie-chicken lek attendance increased at a slower rate (6 versus 9 percent annual rate of change), and sharp-tailed grouse lek attendance decreased at a slower rate (–5 versus –11 percent annual rate of change) relative to the larger Sandhills region (Nebraska Game and Fish Commission unpublished data).

Together, these effect sizes suggest that displacement of prairie grouse may lead to reduced demographic rates. Individual studies have drawn similar conclusions but few have examined these impacts at the scale of this review (Holloran 2005, Hagen et al. 2009, Johnson et al. in press, Walker et al. in press). Several anecdotal reports are available that record the behaviors of individual grouse or small flocks relative to these disturbances (Young et al. 2003, Washington Department of Fish and Wildlife 2008). For example, a greater sage-grouse nest was located within 656 feet (200 m) of the nearest wind turbine, and males were roosting on a turbine pad (Washington Department of Fish and Wildlife 2008). Often, such observations suggest that avoidance is not an issue, but it is critical to differentiate between observations of individuals and population level effects (Aldridge and Boyce 2007). Individuals may still occupy habitats in developed areas because of site fidelity or because they are remnants of suitable habitat (or both). However, there is a biological cost to occupying such sites (i.e., an ecological sink), if predator communities have been altered and increase mortality risks or if new stressors are introduced to the system that reduce primary productivity (Holloran 2005, Aldridge and Boyce 2007, Hagen et al. 2009). Aldridge and Boyce (2007) provide evidence that oil and gas fields in Alberta are habitat sinks and pose a significant threat to local populations of greater sage-grouse. Thus, it is probable that individual prairie grouse will occupy habitats proximate to anthropogenic features, but their fitness may be compromised, and consequently their contribution to the sustainability of a local or regional population is uncertain.

Conservation Implications

The results of my synthesis suggest general effects of displacement and subsequently reduced demographic rates in landscapes impacted by energy development. Thus, strategies to protect large landscapes (i.e., refugia) and increase the likelihood of persistence of prairie grouse populations therein are paramount (Doherty et al. in press, Naugle et al. in press). I concur with Naugle et al. (in press) and the analysis of Doherty et al. (in press), both of which advocate for landscape-scale prioritization of grouse habitats based on the breeding density and biology of the species. If implemented, this framework would protect the highest quality areas from associated risks of energy development, but would provide some flexibility in the siting of energy development in less important habitat areas and a context for habitat mitigation. Currently, regional or rangewide maps that prioritize habitats for prairie grouse are needed. Thoughtful planning to conserve the high-priority habitat areas for prairie grouse should enable goals of sustainable wildlife populations and energy generation to be met.

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Federal Wind Energy Development Guidelines: Background and Implications for Private and Public Lands

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The Wind Turbine Guidelines Advisory Committee (Committee) was established in 2007 under the Federal Advisory Committee Act to provide advice and recommendations to the Secretary of the Interior (Secretary) on developing effective measures to avoid or minimize impacts to wildlife and their habitats related to land-based wind energy projects. The U.S. Fish and Wildlife Service (USFWS) chairs the Committee, which includes 22 members representing governments, wildlife conservation organizations and the wind industry.

This Committee's recommendations (Guidelines) to the Secretary contain the Committee's advice regarding policy issues, as well as science-based technical advice on how best to assess and prevent adverse impacts to wildlife and their habitats while allowing for the development of the Nation's wind energy resources. The Committee recognizes that the environmentally friendly development of wind energy and the protection of the Nation's natural resources are priorities for both the Administration and the American people. For example, on March 11, 2009, the Secretary issued Secretarial Order 3285, making the production and delivery of renewable energy a priority for the Department of the Interior. The Committee therefore developed a set of premises and principles that recognize the delicate balance between wind resource development and the protection of wildlife and habitats. Those principles guided the Committee's discussions and are the basis upon which its advice is founded.

The Committee recognizes that these Guidelines require new activities and increased effort by the USFWS. The Committee urges that the necessary resources to fulfill these responsibilities be made available to the USFWS. In addition to these new USFWS activities, the Committee recognizes that wind energy developers who voluntarily adhere to these Guidelines will be undertaking a robust level of wildlife impact analysis, and a shared responsibility with USFWS to ensure that the scientific standards of the Guidelines are upheld and used to make wise development decisions. To further demonstrate a commitment to wildlife conservation, the Committee recognizes and encourages the wind energy industry's participation and support of partnerships such as the American Wind Wildlife Institute, National Wind Coordinating Collaborative, Grassland Shrub-Steppe Species Collaborative, and the Bats and Wind Energy Cooperative to promote needed research about wildlife and wind energy interactions.

The Committee encourages USFWS to seek partnerships among the wind energy industry, federal, state and tribal governments, and conservation organizations, to continue the relationships formed and strengthened through this process, and to assist in fulfilling new and existing responsibilities.

The Committee's Guidelines are founded upon a "tiered approach" for assessing potential impacts to wildlife and their habitats. The tiered approach is an iterative decision-making process for collecting information in increasing detail, quantifying the possible risks of proposed wind energy projects to wildlife and habitats, and evaluating those risks to make siting, construction and operation decisions.

Subsequent tiers refine and build upon issues raised and efforts undertaken in previous tiers. At each tier, a set of questions is provided to help the developer identify potential problems associated with each phase of a project and to guide its decision process. The tiered approach is designed to assess the risks of project development by formulating questions that relate to site-specific conditions regarding potential species and habitat impacts. The tiers are outlined briefly as:

- Tier 1 – Preliminary evaluation or screening of sites (landscape-level screening of possible project sites)
- Tier 2 – Site characterization (broad characterization of one or more potential project sites)
- Tier 3 – Field studies to document site wildlife conditions and predict project impacts (site-specific assessments at the proposed project site)
- Tier 4 – Post-construction fatality studies (to evaluate direct fatality impacts)
- Tier 5 – Other post-construction studies (to evaluate direct and indirect effects of adverse habitat impacts and how they may be addressed)

This framework allows the developer to determine whether he or she has sufficient information, whether and/or how to proceed with development of a project, or whether additional information gathered at a subsequent tier is necessary to make those decisions. The Committee agrees that incentives should be available to those developers who demonstrate due care by voluntarily implementing the tiered approach and through coordination with USFWS early and throughout the tiered process.

The Guidelines provide best-available methods and metrics to help answer the questions posed at each tier. The Committee recognizes that substantial variability exists among project sites and recommends methods and metrics that should be applied with the flexibility to address the varied issues that may occur on a site-by-site basis, while maintaining consistency in the overall tiered process. As research expands and provides new information, these methods and metrics will be updated to reflect current science.

Other elements in the Guidelines include a full discussion of mitigation policies and principles; the applicability of adaptive management, including the potential use of operational modifications; and considerations related to cumulative impacts, habitat fragmentation and landscape-level analysis. Finally, the Guidelines discuss the need for additional research and collaboration related to potential wind energy/wildlife impacts, and offer some alternatives for accomplishing the needed research.

Workshop.
Transformation of State and Provincial Fish and Wildlife Agencies: Challenges and Opportunities for Leaders

Cosponsored by Cornell University's Human Dimensions Research Unit and the Wildlife Management Institute

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Expectations and calls for change in public fish and wildlife management have been recognized for almost three decades. Change with respect to programs, governance and funding of state and provincial fish and wildlife agencies (SFWAs) in particular has become a growing part of the professional narrative. Uncounted numbers of conference sessions and presentations have called for change and addressed forces motivating change, speculated about impediments to change, and even offered some suggestions for influencing societal trends that impact the fisheries and wildlife management professions. Despite much deliberation about agency change, little direction has been offered to date for achieving effective change that allows SFWAs to be positioned better to meet societal mandates and forge a resilient fish and wildlife management institution for the 21st century. The ability of SFWAs to meet the needs of traditional stakeholders (i.e., hunters and anglers) almost certainly will be compromised if agency programs and activities are not expanded to meet the needs of a broader suite of interests. Nontraditional stakeholders represent a considerably larger proportion of the American public than anglers and hunters do. If SFWAs do not broaden their scope to meet the needs of the broader set of people in contemporary society who are interested in fish and wildlife, they may become irrelevant and subsequently forego the resources and public support necessary to maintain traditional programs and their roles as primary stewards of fish and wildlife resources.

The purpose of this full-day workshop is to offer a framework for enabling change in SFWAs, specifically looking at factors that have led to success, and organizational and institutional barriers that have impeded progress. Via case study examples, presenters will set the stage for small group discussion resulting in specific suggestions for how SFWAs and partners can work together to overcome impediments and manage change to best meet stakeholder needs and fulfill their public trust obligations.

Fish and Wildlife Conservation and Management in the 21st Century: Understanding Challenges for Institutional Transformation

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Societal pressure for change has resulted in transformation of the state fish and wildlife management institution (Institution i.e., the people, processes and rules, as well as the norms, values and behaviors associated with state fish and wildlife management) (Jacobson and Decker 2006). Part of this change is the de-institutionalization of the traditional funding mechanism for state fish and wildlife agencies (SFWA). The traditional funding mechanism for SFWAs has been revenue from hunting and fishing license sales and federal excise taxes (Pittman-Robertson Wildlife Restoration and Dingell-Johnson Sport Fish Restoration funds). In the last 30 years, the Institution has recognized the need to reform the traditional funding model (Heberlein 1991, Hamilton 1992, Franklin and Reis 1996, Bies 2005) due to difficulties in sustaining existing activities as well as expanding into new program areas (Hamilton 1992, Anderson and Loomis 2006). Specifically, this model reinforces historical dependencies between hunters and anglers and the organizations (i.e., state fish and wildlife agencies) that are funded by them. It has been suggested that funding of state management has "blurred the essential distinction between public interest and special interest and inevitably eroded both scientific credibility and public trust" (Gill 1996: 63). Hamilton (1992) asserts that SFWAs' dependency on consumptive user groups to fund wildlife conservation and management leaves agencies in vulnerable positions. Further, the current funding paradigm, according to Anderson and Loomis (2006), perpetuates a client (i.e., hunters and anglers) versus stakeholder (i.e., all interested citizens) approach to fish and wildlife management (Hamilton 1992). SFWAs will need to develop alternative funding mechanisms to sustain their capacity to provide diverse conservation and management services that benefit consumptive and nonconsumptive users alike. Hamilton (1992) notes that it is not likely that SFWAs will become "extinct," but that their legitimacy with new as well as traditional stakeholders may be compromised. One way that SFWAs can maintain legitimacy with a changing society is by increasing their efforts to be responsive to the needs of a diversity of stakeholders interested in fish and wildlife (Decker and Chase 1997).

As traditional funding for state fish and wildlife management becomes increasingly inadequate (e.g., because of declining hunter and angler numbers and corresponding license revenues in some states, increasing demands and subsequent costs of fish and wildlife management), most states have sought alternative funding (e.g., state general funds, tax check-offs, lottery funds) (Hamilton 1992). These new revenue sources present challenges to the Institution (Jacobson et al. 2007). In addition to the creation or expansion of programs, agencies using new and general funding sources will likely need to be more accountable to a larger and more diverse constituency. It will be incumbent on the Institution to overcome an historical dependency on funds derived from hunting and trapping without alienating traditional constituencies. Putnam (1993: 179) notes that tensions emerge as institutions "bearing the imprint of the past" try to address current and future problems.

The resource dependency perspective posits that organizations become dependent on those entities that have control over critical resources, particularly when options for obtaining those resources are limited (Johnson 1995). Pfeffer and Salancik (2003: 3) note that "problems arise not merely because organizations are dependent on their environments, but because these environment are not dependable." When environments change, organizations are forced to adapt or fail to survive. Diversification is one strategy used by organizations

to "diminish the criticality of a particular exchange relationship" (Pfeffer and Salancik 2003: 111). The resource dependency theory offers a unique perspective for helping us understand impediments to organizational change and ways in which SFWAs might transform to accommodate a changing society. The extent to which resource dependency impacts the Institution's ability to maintain legitimacy in contemporary society has not been examined. The purpose of this paper is to offer: (1) a framework for understanding how the traditional funding model for SFWAs has shaped the status quo and influences SFWAs' ability to transform to meet changing societal interests; (2) case study data to examine whether and how resource-dependent organizations change; (3) insights into how SFWAs have secured and maintained alternative funding; and (4) implications of our findings for SFWAs seeking to maintain legitimacy with contemporary society.

Organizational Transformation

As the historical mechanism for state wildlife management becomes less dependable, SFWAs will need to break free from dependencies or risk becoming ineffective (i.e., unable to meet the diversity of wildlife-related interests). An inability to be responsive to diverse societal needs could result in SFWAs losing legitimacy to society. Hamilton (1992) stresses that SFWAs that continue operating under the traditional funding paradigm will face significant threats to programs because of funding shortfalls. He suggests that securing a diverse funding base, including traditional sources, is critical to meet societal demands and conserve fish and wildlife. Like many other examples of institutional change, transformation from the traditional to a nontraditional model for funding fish and wildlife management will be incremental and likely met with resistance. Aldrich (1999) defines organizational transformation as a major change that occurs along three possible dimensions: goals, activities and boundaries. According to Aldrich (1999), organizational research has identified two primary elements of goal transformations: (1) changes in the breadth of organizational goals, particularly evolution from specialism to generalism; and (2) changes in the domain served by an organization. These elements are often correlated.

The second dimension of transformation includes changes in activities that have a significant effect on organizational knowledge (Aldrich 1999). Transformation in activity systems might involve changes in products and services provided due to the introduction of new technologies or management systems, as well as changes in the availability of resources. Expansion and contraction of boundaries is another way organizations change. Organizational boundaries are delineated by membership, both of individuals and organizations (Aldrich 1999). Consistent with resource dependency theory, diversification is a strategy to minimize dependence on critical exchange relationships.

Study Purpose, Scope and Methods

Our research sought to assess whether and how highly resource-dependent organizations transform due to changes in their dominant funding paradigms. We used a multiple-case-study design with a mixed-methods approach (Tashakkori and Teddlie 1998) to explore whether or not SFWAs that had established nontraditional funding sources were more likely to demonstrate organizational transformation toward responsiveness to a diverse constituency compared with SFWAs that relied on more traditional funding mechanisms. A two-tailed (i.e., sampling for extremes) approach (Yin 2003) was used to identify four case study states, with the SFWA being the unit of analysis. The states had the following characteristics: (1) two SFWAs that had established nontraditional, state-based funding that comprised a significant portion of their total funding (greater than 40 percent of their total budget), the Missouri Department of Conservation and the Arkansas Game and Fish Commission; and (2) two SFWAs that relied primarily on traditional funding (greater than 70 percent of their total budget), the Maine Department of Inland Fisheries and Wildlife and the New Mexico Department of Game and Fish. Data collection consisted of semi-structured interviews with key stakeholders and review of documents (e.g., budgets, organizational charts, annual reports). Interviewees included state agency leaders (i.e., but at different levels within the agencies' hierarchies); SFWA administrators; nontraditional staff (e.g., education/communication specialists, nongame program leaders, and planners and human dimensions staff); supervisors/area managers; leaders from mainstream conservation groups; and decision makers such as

legislators (and/or legislative staff) and board/commission members. All four agencies managed both fish and wildlife, but we focused our investigations and interviews on wildlife programs, largely because pressure for boundary expansion in wildlife conservation has historically been greater (Franklin and Reis 1996). Although some conservation issues differ between fisheries and wildlife, we believe that the implications of our findings apply to agencies as a whole. Detailed information regarding methods used in this study and analyses of data can be found in Jacobson (2008).

The primary assumption of this research was that SFWAs' responsiveness to a diversity of stakeholders was central to their continued legitimacy with society. The question guiding this research was: How are SFWAs that have nontraditional funding similar/different from those that rely primarily on traditional funding in terms of their ability to meet the needs of a diverse constituency?

SFWAs with Secure, Alternative Funding

Organizational Goals

Staff from both agencies (Arkansas Game and Fish Commission [AGFC] and Missouri Department of Conservation [MDC]) stressed that prior to securing sales tax revenues, their SFWAs recognized that organizational goals needed to be expanded to address a diversity of wildlife-related interests, including nongame research and management, education, watchable wildlife, and nongame habitat acquisition. As part of their campaigns to generate support for the sales tax initiatives, both states made considerable efforts to conduct social and economic analyses to understand public interests and the feasibility of various funding approaches. Both MDC and AGFC also made commitments to the public, via their Design for Conservation and Plan for Conservation, respectively, regarding how sales tax revenues would be used to meet public needs.

MDC maintains a feedback loop with the public via survey research, planning and outreach. In their latest strategic plan revision, MDC related each of its goals to interests identified by the public (Conservation Commission of the State of Missouri 2006). Although AGFC has made considerable progress in fulfilling the promises outlined in the Plan for Conservation (e.g., land acquisition, nature centers, more enforcement officers), unlike MDC, it is in the early stages of development for a mechanism to facilitate dialogue with the public to improve accountability.

According to interviewees in Missouri and Arkansas, goal expansion was critical prior to securing the sales tax, and maintenance of a "public service" approach—the public being voters of their states—was institutionalized in both SFWAs. Staff from MDC and AGFC recognized that the sales tax was under continual political scrutiny and that broad public support, as well as support from a diversity of organizational partners, was needed to maintain the level of programs and services the sales tax revenue allowed them to provide.

Interviewees in Missouri and Arkansas identified how the availability of alternative funding facilitated a transformation from traditional SFWAs focused on game management to SFWAs with broader conservation foci. The availability of additional funding allowed both SFWAs to fulfill broader visions expressed prior to securing the sales tax in addition to providing resources to hire staff and pay for tangible items such as equipment and nature centers. The role of funding in broadening organizational goals was not underestimated by interviewees.

Although additional funding necessarily increased SFWAs capacity to provide a diversity of benefits, strategic designs to meet the expressed interests of the general public were key to the successful funding campaigns. Both MDC and AGFC staff referred to public accountability as important in defining the direction of their agencies. When discussing their efforts to offer a diversity of services, staff from both agencies highlighted the importance of accountability to the public.

For both Missouri and Arkansas, availability of the sales tax was intimately tied to promises made to a diverse public (i.e., statewide voters). Subsequently, the goals of the SFWAs were broadened to assure accountability to the voting public.

Organizational Activities

The two states with alternative funding demonstrated considerable diversity in the services and programs offered. For example, both MDC and ADGF had: (1) produced conservation magazines; (2) constructed and maintained nature and wildlife education centers; (3) acquired land to increase access to wildlife for both consumptive and nonconsumptive stakeholders; (4) offered a breadth of educational programs and opportunities; (5) implemented urban-/suburban-focused programs; and (6) provided innovative programs to address issues related to private landowners.

Interviewees from nongovernment organizations (NGOs) outside of the two SFWAs were encouraged by the expansion of agency programs and staff. In both states, nontraditional NGO leaders interviewed believed that the services provided by the SFWAs were in line with the interests of their organizations' memberships. Both agency and NGO staff attributed the ability of these agencies to diversify their programs to the availability of sales tax revenue.

Agency staff in both states were confident that significant public support existed for their agencies, primarily because they had made demonstrable progress toward fulfilling promises they had made to the people as part of their funding campaigns. Both MDC and AGFC prepared plans during their campaigns for how the funding would benefit all of the people of their states via expansion in breadth and depth of agency activities. Accountability to the public was a theme that emerged in both SFWAs. For both SFWAs, the availability of a diverse funding source necessitated and facilitated expansion of program activities beyond fish and game management.

Organizational Boundaries

Both MDC and AGFC established enduring partnerships with NGOs and other entities, both traditional and nontraditional. The importance of partnerships in accomplishing these SFWAs' conservation goals was emphasized by SFWA and NGO staff. Specific outcomes of partnerships included provision of funds and staffing, land acquisitions, and sharing of knowledge and expertise. Further, the investment in these partnerships yielded a return in political capitol when their funding source came under challenge. For both SFWAs, partnerships were integral to their organization and building and maintaining these relationships was a conscious effort.

Partnerships were considered central in achieving the goals of both organizations. Although both SFWAs had relatively stable and consistent funding, the ability to hire additional staff to meet growing public demands or to match federal money (e.g., State Wildlife Grants [SWG]), was a concern. Interviewees noted that partners were important sources of expertise and resources that were not necessarily available within their agencies. For example, Missouri's Bird Conservation Initiative, a coalition of 46 diverse organizations whose purpose is to conserve, restore and protect bird populations, is an example of a partnership spearheaded by the MDC to help establish collective conservation goals and serve as a conduit in providing financial support to organizations seeking to meet these conservation goals.

Some NGOs had antagonistic relationships with AGFC or MDC, but relationships with most NGOs were positive, based on reports from interviewees. For example, NGO leaders interviewed interacted with various staff members on a weekly and even daily basis. Similarly, agency leaders provided examples of how they had worked collaboratively with a diversity of organizations on specific issues as well as through enduring partnerships via large coalitions or frequent interaction and involvement with partners.

Broadening partnerships did not eliminate all conflicts for AGFC and MDC, but it allowed them to expand upon common ground with most conservation NGOs. This resulted in conflicts occurring more at the fringes and much less at the center of the conservation community.

SFWAs without Secure Alternative Funding

Organizational Goals

Both Maine Department of Inland Fisheries and Wildlife [MDIFW] and New Mexico Department of Game and Fish [NMDGF] demonstrated efforts to expand the domain served by their agencies. For example,

many MDIFW staff believed that, for nearly two decades, game, nongame, and habitat research and management were integrated into their SFWA's culture, even though funding was primarily derived via traditional sources. A shortage of funding, however, compromised both traditional and nontraditional programs.

Many interviewees in Maine, both within and outside of the agency, thought that lack of funding was an impediment to MDIFW's ability to achieve its goals. NGO leaders interviewed were concerned with the lack of funding and how that limited MDIFW's ability to manage nongame species and educate people about wildlife. Most interviewees identified a paucity of funding, not a lack of interest or motivation, as the reason why MDIFW had limited capacity to diversify agency activities.

In New Mexico, some interviewees thought that goal expansion was occurring, although slowly due to political factors, such as lack of public support for increasing NMDGF's general fund appropriation, resistance from traditional stakeholders and an inability to secure legislative approval for additional staff positions. Other interviewees thought that a traditional organizational culture hindered expansion of agency goals: "In many ways, we're a really traditional hook and bullet agency and it's only been in the last five or six years that that's started to shift slowly." Unlike MDIFW, game and nongame research and management were, for the most part, segregated in NMDGF, and interviewees noted that the clear majority of funding was focused on game-related staff and activities. Aside from the availability of SWG money, nontraditional programs were losing ground in terms of funding. For example, a commissioner in New Mexico thought that lack of staff and funding were the biggest problems NMDGF had and was supportive of broadening the funding base to stakeholders that benefit from but currently do not financially support the SFWA.

MDIFW and NMGFD had made efforts to broaden the domain served by their agencies. MDIFW staff demonstrated that the goal to be responsive to a diversity of the public was ingrained in the SFWA's culture. Interviewees in New Mexico thought that NMGFD was changing, particularly in recent years, but that it still was primarily a traditional agency.

Organizational Activities

Both SFWAs were engaged in some efforts to provide a diversity of services to the public. For example, MDIFW managed two educational and watchable wildlife sites, produced a quarterly fish and wildlife magazine, and spearheaded a collaborative program (Beginning with Habitat) to identify and maintain habitat for native plant and animal species in Maine. NMDGF, according to leadership, was a traditionally focused SFWA in terms of budget and services provided, although it offered some programs and services oriented toward nontraditional interests (e.g., Gaining Access Into Nature). In addition, NMDGF had a Conservation Services Division that focused on broad issues related to game and nongame species (e.g., habitat management, endangered species). Although both agencies had diversified programs and services to some extent, interviewees from both states considered their resources inadequate to address the breadth of public interests and expectations in their states. In New Mexico, an inability to hire new staff was frequently mentioned as an impediment to NMDGF's capacity to maintain and grow programs.

In Maine, a lack of funding and related implications (e.g., inability to hire staff for nontraditional programs) was the primary focus of concern. Leaders from MDIFW expressed concern that staff was overextended in their efforts to meet the expectations of citizens of the state.

NGO leaders interviewed suggested that MDIFW was considerably underfunded and, because of that, was compromised in its ability to be creative or responsive to the conservation needs of the state.

Although MDIFW had made demonstrable efforts to broaden its programs beyond game management, most interviewees, including agency staff, agreed that the MDIFW did not have the resources to maintain and grow these programs.

NMDGF staff realized the need to be responsive to changing and increasing public interests and demands. However, it was acknowledged by many staff that historical relationships with traditional stakeholders made responsiveness to a broader constituency challenging. Similarly, NGO interviewees thought that NMDGF was diversifying but still focused primarily on traditional activities.

Resistance to changing its name, for example, was attributed to the historical dependency between NMDGF and its traditional stakeholders. Although there was recognition of the demand to diversify programs and services provided by NMDGF, most staff and NGO leaders thought that the process was evolving slowly.

Interviewees from both states identified ways in which their SFWAs were transforming due to changes within the Institution (e.g., the SWG program) and outside of the Institution (e.g., a changing society). In Maine, dependency on traditional funding did not limit the SFWA's proclivity to expand its activities, but a lack of resources to support expansion did. In New Mexico, the SFWA is steeped in a traditional culture that defines budget allocations, staffing and programmatic decisions. According to some interviewees, change is occurring at an appropriate pace. Although availability of alternative funding could facilitate expansion of public expectations, many interviewees expected that the nature of NMDGF would not change substantially. Although leaders believed that their agency was in a transitional state, they believed it was slow and appropriate for the interests and needs of the people of New Mexico.

Organizational Boundaries

The existence of enduring partnerships with NGOs, both traditional and nontraditional, was not a theme that emerged often in interviews with staff from NMDGF or MDIFW. Although partnerships did exist because of specific projects (e.g., MDIFW's Beginning with Habitat program), these partnerships tended to be project, issue or species focused, and were not generally characterized as institutionalized partnerships (i.e., enduring, mutually beneficial relationships).

Both SFWAs had engaged in efforts to expand relationships with NGOs via public involvement requirements to develop their State Wildlife Action Plans (SWAP). Both SFWAs had done so to some degree. For example, at the time of data collection, NMDGF had contracted with a third party to strengthen and establish partnerships built during their SWAP development process. This effort and the considerable resources allocated to implement it is a clear example of boundary expansion to nontraditional partners. Through its species planning processes, MDIFW builds relationships with traditional and nontraditional groups.

Although, according to one agency leader, relationships have improved between his SFWA and some groups, it has remained tenuous with others. For example, he described how some mainstream groups, consumptive and nonconsumptive oriented, had opposed each other politically on opportunities to secure alternative funding for their SFWA, and therefore, the ideas had not generated the political capital necessary to succeed. Interviewees in both states expressed concern about the impacts of adversarial relationships between traditional and nontraditional groups.

This interviewee, as well as other agency leaders from both states, thought it would benefit their SFWA to facilitate partnership building among wildlife interest groups.

Both SFWAs worked with NGOs and other entities on a regular basis, but according to staff in both states, no effective coalitions had been formed to build political support necessary to secure adequate funding for the agencies.

Both SFWAs had made some efforts to expand partnerships beyond traditional groups, but neither had garnered the political capital necessary to secure resources needed to support their agencies.

Discussion

Resource dependency theory offers a perspective to help us understand relationships between organizations and their resource base. The theory posits that it is in an organization's best interest to minimize dependence on a single resource (Pfeffer and Salancik 2003), particularly in the face of changing environmental conditions. In the case of the Institution, the traditional mechanism for funding state wildlife management functioned adequately until changing environmental factors pressured the Institution to reform (Anderson and Loomis 2006). Jacobson et al. (2007) examined SFWAs' responses to institutional pressure to minimize dependency on traditional funding by securing alternative funding sources. Most SFWAs had exhibited strategic behavior to obtain funding, but the majority had not reached their desired funding goals. For some SFWAs, obstacles (e.g., real or perceived environmental determinism) impeded their efforts to diversify the traditional funding model. We used a case study approach to provide in-depth insight into how highly resource-dependent organizations manage interdependences in response to a changing institutional environment. We expected our inquiry to reveal two distinct organizational models that reflected the difference between the divergent funding mechanisms. We found that organizational transformation had occurred in SFWAs with and without secure

alternative funding; however, the extent and depth of that transformation depended on exogenous (e.g., societal and institutional) and endogenous (i.e., internal organizational) factors and was facilitated, but not contingent on, minimizing dependence on a single resource.

Consistent with organizational behavior described in resource dependency theory (Pfeffer and Salancik 2003), MDC and AGFC diversified their funding bases and thereby minimized their dependence on a single stakeholder group for resources. Our research showed that in response to exogenous pressures for expanded programs and services, both MDC and AGFC identified the need for additional funding as a means, not as an end in itself. Prior to their campaigns to secure alternative funding, both SFWAs developed a clear vision for goal, boundary and activity expansion beyond a traditional focus and began to implement new programs on a limited basis. They applied social science to study public needs and used the results to inform and develop their vision. The expanded visions, programs and public accountability of these SFWAs represent a manifestation of organizational culture change—a critical antecedent for strategically expanding their funding bases.

Both MDIFW and NMDGF exhibited strategic behavior to minimize their dependencies on traditional funding. They differed from MDC and AGFC in that organizational goals had not been effectively broadened to position them to be able to achieve their funding goals. For MDIFW, a conscious effort was made toward expanding organizational goals via integration of game and nongame programs and proactively including the public in establishment of management goals and objectives. MDIFW lacked strong and diverse partners willing to advocate politically for increased agency funding to achieve expanded goals and meet the diversity of demands of the people of their state via activity expansion. MDIFW leaders expressed the need for their agency to take an active role in expanding partnerships, both between themselves and other organizations, as well as among other organizations. Unlike MDC and AGFC, MDIFW had not translated goal expansion into a strategy to gain political capital necessary to secure alternative funding.

Similar to the other three SFWAs, NMDGF had diversified to some degree via goal, activity and boundary expansion. For example, establishment of a statutorily created Conservation Services Division brought more of a nontraditional focus to the agency. Most resources and subsequent programs, however, were still directed toward traditional activities. Further, interviews suggested a lack of emphasis on boundary expansion via partnership building and public needs assessments. The limited extent to which NMDGF had diversified reflects the deep traditional focus of both endogenous and exogenous interests; pressure to diversify was perceived to be minimal. A complete cultural shift toward diversification had not been fully embraced by the agency. Because NMDGF maintained more traditional goals for programs and services, the lack of alternative funding presented less of an obstacle for them. Nevertheless, they had gradually expanded the activities and boundaries as they deemed appropriate to address public needs and expectations within their state. Their investment in an implementation and outreach effort for their State Wildlife Action Plan reflects such gradual broadening.

Our results suggest a need for a strategic step-wise approach to organizational transformation and ultimately securing and maintaining alternative funding. This approach includes: (1) leadership that promotes a cultural change toward broadening goals; (2) development of a strategy to expand organizational boundaries and grow coalitions including traditional and nontraditional groups; (3) assessment of public interest and design of a feedback loop to demonstrate accountability; and (4) expansion of programs and services promised as part of SFWAs' funding campaigns. Without first expanding their organizational cultures to embrace the need for diversification, SFWAs will likely be unable to effectively garner public and political capital necessary to meet their funding needs. Perhaps the real impediment to securing alternative funding is the belief that lack of funding is the problem. Recognizing that lack of funding is a symptom of a larger problem—declining relevance of SFWAs to a changing society—can lead to organizational transformation that will increase SFWAs' relevance. While many SFWAs believe that agency transformation cannot occur until they have new or increased funding, our findings suggest increased funding is unlikely until agency transformation occurs.

Management Implications

Our results suggest that it would benefit SFWAs to promote internally first and with traditional partners and policy makers an understanding and acceptance of the need for organizational transformation. By embracing a broader diversity of public interests and developing a strategy for change, SFWAs will increase their chances of achieving funding goals and, perhaps more importantly, maintaining legitimacy with society. Politically savvy leadership in SFWAs is needed to progressively change organizational culture and champion agency vision. In addition, SFWAs need to forge partnerships that will engender broad-based support and advocacy for the agency among the NGO community. Finally, SFWAs need to develop systematic approaches to maintain accountability to the public.

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Understanding Organizational Transformation: Leading Versus Managing, Thinking Versus Doing

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State fish and wildlife agencies (SFWAs) are under pressure to change, perhaps urgently, for the future of fish and wildlife conservation. We address two topics relevant to this situation: (1) organizational transformation and (2) leadership of transformative change. This paper is based in part on scholarship on these inter-related topics and in part on our observations of organizational change and leadership. Our primary purpose is to facilitate thinking about agency transformation and leadership of it.

Transformational pressures can originate within or outside an organization, or from both directions simultaneously. Evidence of the need to change includes: new and increasing demands on SFWAs; reduction in political support; decline in size and influence of traditional stakeholder groups; emerging nontraditional stakeholder groups; use of strategies such as ballot initiatives and litigation to thwart established decision-making processes; other organizations (e.g., nongovernment organizations [NGOs]) filling in gaps where agencies lack resources (e.g., funds, expertise or staff); attempts by other agencies or commercial entities to assume SFWA responsibilities; and attempts to establish parallel entities (agencies) to deal with the unmet needs.

These pressures may be felt to varying degrees by anyone in an agency, but the responsibility to change directions and mitigate impacts falls largely to leaders. Fortunately, we have many capable leaders in SFWAs. Leadership ability exists not only among agency staff in upper management but also among those who are not in formal leadership positions. Nevertheless, in general we suspect SFWAs are not transforming rapidly enough to keep up with changing societal expectations or to sustain broad relevancy. Thus, we have a paradox: the *leaders* exist, but *leadership* directed at transformative change is lacking.

Our hypothesis is that too many leaders are submersed in managing (i.e., putting out brush fires between stakeholders and among sister agencies, dealing with political pressures and litigation, and budgeting with declining resources) versus providing leadership needed to address comprehensively the process of agency transformation. That thesis grounds our thinking about what needs to happen to *lead* SFWAs into the future, as opposed to *manage* them day to day. It also sets the direction of this paper. We start by discussing some key components of organizational transformation and then move to transformative leadership. We present an impressive case study of agency transformation in Florida. We conclude with some thoughts about what needs to happen before SFWAs can start down the path of transformative change.

Organizational Transformation

Small-scale change occurs all the time within organizations, but organizational transformation is uncommon. Our recent research (Jacobson 2008) was guided by a definition of transformation proposed by Aldrich and Ruef (2006: 134): "a major or substantial change in organizations involving a break with existing routines and a shift to new kinds of competencies that challenge organizational knowledge." Organizational transformation typically is met with resistance in an established bureaucracy, and is further impeded when historical dependencies, especially resource dependencies, serve as barriers to change (Pfeffer and Salancik 2003).

Institutional change theory has focused on two perspectives (Aldrich 1999). One considers change to be an outcome determined largely by external or "environmental" forces. The other perspective attributes organizational change to internal factors or qualities of organizations. Environmental determinism refers to the extent to which outside influences control an organization's abilities to make choices about their futures (Astley and Van de Ven 1983). In

general, this deterministic perspective holds that organizations are highly influenced by or dependent on those organizations or individuals that control the resources necessary for survival (Pfeffer and Salancik 2003). The internal control, "voluntaristic" perspective, posits that organizations are autonomous, proactive and self-directing; they are able to make strategic choices about their futures (Astley and Van de Ven 1983). Blending both viewpoints, Oliver (1991) contends that although exogenous factors influence organizational behavior, organizational self interest is a powerful force driving organizational change. Further, taking this view, organizations have the ability to respond to pressures for change in a strategic manner. In other words, according to Oliver (1991), change is considered an outcome determined by the give and take of environmental versus internal factors.

Our recent study explored how SFWAs have responded to pressures to change, specifically pressure to develop alternative funding mechanisms (Jacobson 2008). Were SFWAs impeded from securing new funding sources by external constraints or were they able to lead strategic change efforts, and if so, how? Interviews with SFWA leaders revealed that most agencies faced powerful external factors that impeded change; strategic choice did not appear to be an option for many of them. This sense of inefficacy is particularly characteristic of government agencies that are strongly influenced by external forces (Wilson 2000) such as policy-making bodies (e.g., boards/commissions) that have budgetary or other oversight authority. Nevertheless, some SFWAs had overcome internal and external obstacles and successfully secured nontraditional funding. They have transformed strategically in response to changing societal conditions, even under challenging circumstances.

Like many examples of institutional change, transformation from the traditional to a new model for SFWAs should be expected to meet resistance (Tolbert 1985). Nonetheless, transformative change has occurred in SFWAs where: (1) leadership promoted cultural change conducive to broadening goals; (2) strategies to expand organizational boundaries and grow coalitions included traditional and nontraditional groups; (3) public interest was assessed and accountability was demonstrated; and (4) expansion of programs and services was promised, for example, as part of funding campaigns. Thus, SFWAs have exhibited change along three dimensions: goals, activities and boundaries (Aldrich and Ruef 2006)**.** These dimensions of change are adjustments that enable or indicate transformative change, but they are not the *transformative force* behind such change. It seems to us that changes in all three dimensions are predicated on ***a change in vision for the organization*.** Fundamentally, that is the real transformative force.

Envisioning a New Future is Necessary for Fundamental Change

Our research suggests that it would benefit SFWAs in the long term to promote a vision of the future, first internally and then with external groups and policy makers, that is robust to the needs and interests of many stakeholders. If such a vision gains widespread support, internal and external acceptance of the need to diversify programs and services to meet broad societal needs might be achieved regardless of the agency's dominant funding source. By creating a vision that embraces a broader suite of public interests, reaches out to a diversity of partners and leads to a strategy for change, SFWAs are more likely to meet funding needs over time and, more importantly, maintain legitimacy with society.

A transformative vision addresses *who, what* and *how* of an agency's mission. This is another way of thinking about Aldrich and Ruef's (2006) three components of change.

Who are stakeholders and partners (major change in boundary domain and depth).

What are the desired future conditions and outcomes sought through fish and wildlife conservation that are more encompassing of diverse public values vis-à-vis these resources (major change in goals).

How are goals set, decisions made, actions implemented (e.g., co-management), etc., (major changes in services and products).

Although Aldrich and Ruef (2006) developed their ideas about transformative change in an entirely different context, the SFWAs in our study that obtained secure, alternative funding had gone to great lengths to change their organizational cultures (WHAT—broadened their organizational goals) prior to, not after, gaining the diverse funding. Part of that change was building political capacity by partnering with a diversity of groups, both traditional and nontraditional (WHO—broadened boundaries), and offering diverse programs and services (HOW—broadening activity systems). Conversely, those SFWAs without secure, alternative funding had difficulty addressing the growing demands for programs and services. They also were unable to garner the political capital necessary for successful funding campaigns.

Certainly implementing change in goals, activities and boundaries is more easily said than done. It requires traversing new terrain for many SFWAs. At this point in time, we may not have many specific SFWA examples to turn to for guidance, but other areas of human endeavor provide insight to help understand organizational transformation. In that vein, we refer to the work of John Kotter, a Harvard professor who wrote *Leading Change* in 1996; this book has application to SFWAs.

Challenges to Organizational Transformation

Observant fish and wildlife professionals have witnessed many challenges to organizational change. These sometimes appear daunting. Kotter (1996: 20) asserted that change in an organization can be thwarted by:

1) inwardly focused cultures;
2) paralyzing bureaucracy;
3) parochial politics;
4) a low level of trust;
5) lack of teamwork;
6) arrogant attitudes;
7) lack of leadership in middle management; and
8) common human fear of the unknown.

In addition to these eight barriers, we add from our experience three more characteristics of many SFWAs: (1) resource dependency; (2) politically connected stakeholders who may be unsupportive of broadening boundaries; and (3) governance structures that lack broad representation. These challenges to transformative change in SFWAs have not been fully assessed, but we believe they add to the difficulties SFWAs encounter when attempting to affect significant change.

Kotter (1996: 16) identified eight common errors to avoid when spearheading a strategic change process:

1) allowing too much complacency;
2) failing to create a sufficiently powerful guiding coalition;
3) underestimating the power of vision;
4) under communicating the vision by a factor of 10 (or 100 or 1,000);
5) permitting obstacles to block the new vision;
6) failing to create short-term wins;
7) declaring victory too soon; and
8) neglecting to anchor changes firmly in the corporate culture.

These impediments and errors are familiar to anyone working in a SFWA or closely with one. But we need not dwell on familiar problems. Instead, how does one avoid or address them? Fortunately, they are avoidable or at least surmountable, as evidenced by examples of strategic transformative change in SFWAs.

Organizational Transformation: Process and Leadership

Kotter (1996: 21) offered an eight-stage process for transformative change in an organization. We have adapted his wording to align better with the SFWA situation, but the base concepts are Kotter's. You'll note these are essentially "fixes" for the eight errors or mistakes.

Eight-stage Process

1) Establishing a sense of urgency
    a. Looking at the trends and projections of factors of importance to the agency
2) Creating the guiding coalition
    a. Putting together a group with enough power to lead change
    b. Getting the group to work together as a team
3) Developing a vision and strategy
    a. Creating a vision to help direct the change effort
    b. Developing strategies for achieving that vision
4) Communicating the change vision
    a. Constantly communicating the new vision and strategies
    b. Having the guiding coalition role model the behavior expected of employees
5) Empowering broad-based action
    a. Getting rid of obstacles
    b. Changing systems or structures that undermine the change vision
    c. Encouraging risk taking and nontraditional ideas, activities and actions
6) Generating short-term wins
    a. Planning for visible improvements—wins
    b. Visibly recognizing and rewarding people who make wins possible
7) Consolidating change and producing more change

a. Using increased credibility for change ideas to change all structures, programs and policies that do not fit the transformation vision
b. Hiring, promoting and developing people who can implement the change vision
c. Reinvigorating the process with new projects, themes and change agents

8) Anchoring new approaches in the culture
   a. Creating better performance with respect to stakeholder-oriented behavior, more and better leadership, and more effective management
   b. Articulating the connections between new behaviors and organizational success
   c. Developing means to ensure leadership development and succession

Pitfalls notwithstanding, change is happening within SFWAs (Jacobson et al. 2010). The key may lie in commitment to change and ability to convince stakeholders and policy makers that transformation is in everyone's best interests in the long run.

Transformative Change in the Florida Fish and Wildlife Conservation Commission

To avoid thinking that transformation of SFWAs is nearly impossible, we describe a change process that is well underway in a SFWA. The Florida Fish and Wildlife Conservation Commission (FWC), with 2,200 staff--perhaps the largest SFWA in the United States--has engaged in a process of transformative change since the mid 1990s. Kotter's (1996) eight stages of change provide a useful framework for describing and analyzing FWC's change process.

Establishing a Sense of Urgency

In the mid 1990s, the urgency of making a major change in how Florida's overall conservation effort was organized, how it operated internally and how it interacted with Floridians, became apparent. The Executive Director of the former Florida Game and Fresh Water Fish Commission (GFC) realized that discussions in the state legislature about increasing the efficiency of multiple public lands management programs provided *an opportunity to re-invent the agency*. He began work to move the GFC away from a game harvest focus to a more inclusive fish and wildlife management focus. A citizen-initiated Constitutional referendum created the FWC in 1999, merging the GFC, the Marine Fisheries Commission, and elements of the Divisions of Marine Resources and Law Enforcement of the Florida Department of Environmental Protection. A biologist who had designed a proactive nongame program and its innovative funding source from new motor vehicle registrations (taking advantage of Florida's explosive population growth) was selected in 1998 to lead and implement the merger.

Creating the Guiding Coalition

In May 2002, an individual who served previously as Director of FWC's Fish and Wildlife Research Institute was appointed Executive Director. One of his first actions was a series of emails to all staff to share his views about FWC mission and operations, and where he wanted to take the agency. He set a standard of open and regular communication, and his frequent discussions with staff and stakeholders about expectations helped create a common understanding of the agency's future direction. Consistent messages, in a variety of formats, included "going from good to great" and "to be recognized as the premier fish and wildlife agency in the U.S." A Senior Leadership Team (SLT) of 28 people was formed to articulate and implement the new direction. They dealt with major merger issues during the first few years, such as combining different organizational cultures, particularly marine and terrestrial/freshwater law enforcement. (Enforcement methods and work scheduling were very different between these historically distinct groups, so FWC decided to cross-train officers to optimize their effectiveness in whatever area needed enforcement.)

In June of 2002, a private consulting company was hired to help guide the SLT through a revision of the agency's strategic plan, shifting from a focus on major initiatives to *how* FWC should operate in the future. The consultants brought experience with strategic planning from the federal government and private sector. They challenged the SLT to think beyond incremental improvements and consider transformative changes.

Developing a Vision and Strategy

The SLT, with strong guidance from the FWC Executive Director, developed a vision to help direct the change effort. This involved many levels of leadership within FWC, the Commissioners, and key partners and stakeholders. A strategic planning process developed a commonly embraced mission and strategies for achieving the vision. An initial round of online surveys of stakeholders (110 stakeholder group leaders), employees (1,200 staff responses) and the general public was conducted during summer 2002. Several key themes emerged:

- identify and better understand emerging stakeholder groups (e.g., wildlife viewers and hikers);
- develop strategies for addressing tensions between stakeholder groups;

- FWC needs to be better recognized as the conservation leader in Florida;
- increase and leverage partnering;
- think bigger and broader; and
- stick to science as a basis for decision making.

Leaders of stakeholder groups were invited to discuss survey results and decide on changes to refine FWC's focus. Drafts of a new vision, goals and strategies were created.

In September of 2002, 80 staff from a cross-section of each division and office in FWC met to review the draft vision, goals and strategies and to develop initial division and office strategic plans. Upon reviewing the results, the SLT discovered this group was codifying the *status quo* rather than implementing the new direction. Basically, the existing organizational structure was not conducive to delivering on the new direction. The SLT realized to get fresh thinking from staff, FWC needed a different approach. SLT decided to restructure the agency along the lines of functional activities, e.g., research, management, enforcement, support services. Thus, another significant transformation was undertaken.

In December of 2002, to test one of the underlying concepts of the new structure that would emphasize integrative collaborative work, seven "Issue Teams" with a total of 50 employees from all divisions and offices were formed to address some pressing issues (e.g., endangered snail kite management, Lake Okeechobee water level management, creation of a regional administrative service center). Functioning of the pilot teams was evaluated, and the outcomes and products of the teams were widely communicated. As hoped, staff began to understand and value the perspectives and expertise from others outside their traditional work unit. Supervisory chains began to support "sharing" of staff for work on teams, and this created the foundation of FWC's now widely practiced teaming strategy. Based on the success of the Issue Teams, the SLT refined its thinking on the new agency structure.

Functional area "Advance Teams," comprised of mid-to-senior-level leaders, developed missions and goals for the new organizational units in 2003. The new structure flattened the organization, reducing the bureaucratic levels from seven to four. These multi-disciplinary teams also reinforced the new teaming strategy and created forums for modeling and communicating the new leadership behaviors.

In the spring of 2003, an employee survey was conducted to gather staff comments on the new agency strategic plan–to make sure the SLT was getting it right and to begin to gauge acceptance from staff. A key lesson learned was to drop the use of business jargon and use more plain language. "Ken's Road Show," whereby the FWC Executive Director traveled across the state to meet with staff in groups of 20 to 50, was launched to discuss the new strategic plan and explain why the organization would benefit from restructuring. This effort created a shared sense of understanding and commitment to the change effort. As a follow-up to the "Road Show," the Executive Director distributed regular video messages about current and anticipated actions of importance to the agency, and how staff fit into the bigger picture. Leadership discussions on the restructure, along with the associated spreadsheets showing which division or office various staff might be moved to, were posted for all staff to see and comment on. Additional surveys of stakeholders, general public and staff validated the new agency mission and goals, which shifted from "control" to "influencing" and from "reacting to the issues of the moment" to "leadership on emerging issues."

Before the restructure became effective, FWC contracted with the Association of Fish and Wildlife Agencies Management Assistance Team (MAT) to provide a multi-day training session on managing change. This helped prepare the SLT and key mid-level leaders for the massive challenge of leading an agency in a new direction, where more than 40 percent of staff would change supervisors. The training reinforced the message "we know change is difficult, but we're committed to providing the resources to make it happen." The restructure was approved by the Commissioners, Florida legislature and Governor. It became effective July 1, 2004.

Communicating the Change Vision

Leadership of FWC (Executive Director and SLT) used every vehicle at their disposal to communicate constantly the new vision, mission and strategies. This effort had strong internal and external communication elements. From the outset, the SLT realized they must model the behavior expected of mid-level leaders and other employees. Proclamations of change and reorganization had occurred before within the agencies that were combined to form FWC, sometimes with no result but doing business as usual after a period of confusion. Thus, the level of seriousness with which SLT and other leaders took this new move would be scrutinized and how leaders behaved would largely determine the extent to which "rank-and-file" staff adopted a new stance with respect to agency purpose, inter-agency and intra-agency cooperation, and stakeholder engagement.

In April 2004, FWC began a comprehensive communication campaign with staff to familiarize them with the final restructure design; share thoughts and expectations regarding leadership, work plan integration and support services; and most importantly, explain how each of them fit into the reorganized agency. Inaugurating this campaign, 250 agency leaders from around the state participated in one of five off-site multi-day "Good to Great" meetings. The "Good to Great" concept was borrowed from Collins' (2001) book in which the steps and prerequisites for organizational

excellence are described. These and subsequent smaller, regionally based "Good to Great" meetings communicated the new structure of the agency and provided some initial forums for staff to meet and learn about each others' work activities, resulting in some early wins in new collaborative work activities. More than 30 meetings were held around the state to explain the restructure and answer staff questions. The "Good to Great" reference continues to be used by staff and stakeholders in many venues today.

Frequent communication using a variety of methods keeps the change effort alive and helps staff visualize a desired future (e.g., newsletters to staff and stakeholders, articles in the agency magazine, web articles, presentations to legislative staff and FWC Commissioners, emails and videos from the Executive Director, presentations and discussions at program and project level meetings from leadership). The desire to share this information in different ways helped spawn improvements to the agency's information technology infrastructure.

Empowering Broad-based Action

FWC was created to combine conservation agencies in Florida because their separation was perceived as not leading to the best conservation outcomes. By eliminating some institutional obstacles, lowering remaining barriers, and changing systems and structures that would have undermined the change vision, FWC was able to strike out in a new direction. The assimilation of new people into the organization was done with sensitivity to their prior sense of identity and to their lingering sense of insecurity brought about by the restructure. Articulated by the Executive Director and reinforced down the leadership chain, staff were encouraged not to fear risk taking or nontraditional ideas and activities. Ground rules were established for meetings that made explicit the desire for all staff, regardless of position, to feel unencumbered in sharing ideas, what FWC terms as a "safe haven." The use of multi-disciplinary teams was encouraged and sometimes required. This marked a new way of doing business that has been regarded as successful in dealing with multi-faceted conservation issues.

During the situation analysis stage of the change effort, citizens of Florida clearly communicated the need for FWC to improve its understanding of the concerns emerging stakeholders have for fish and wildlife conservation. An Office of Recreational Services (ORS) was created in the restructure to address this need. ORS is building coalitions with nontraditional stakeholder groups such as birders and paddlers. In so doing, ORS is helping all of FWC better understand, anticipate and mediate user-group conflicts while increasing benefits of fish and wildlife for Floridians. A growing use of social science inquiry is increasing FWC's capacity to understand attitudes and behaviors of nontraditional stakeholder groups.

Not all of FWC's change efforts were successful. For example, one tactic encouraged staff (at all levels) to identify current activities or projects that could be reduced or eliminated in order to realign those resources for other important issues. Despite FWC's best efforts, the exercise was a bust; some staff resisted cessation of long-standing programs or activities. They had a stake in the *status quo* and were afraid of adding more change on top of the uncertainty of the restructure. But since this experiment, agency culture has been changing, and there are signs that cessation of some traditional activities may be viewed as less threatening.

Generating Short-term Wins

FWC leadership recognized the need to generate and communicate short-term wins. For example, a recurring theme among the biologists and law enforcement officers in employee satisfaction surveys was the burden of administrative work. FWC responded by consolidating many operational business functions into regional service centers. This early win for staff demonstrated the commitment of FWC's leadership to improving resource alignment.

Communication of wins for staff had several outcomes. They rewarded staff for testing and embracing new behaviors. They provided opportunities to capture and share lessons learned and adapt approaches. They also helped maintain the momentum of change efforts and demonstrated to skeptics that FWC's operational and conservation outcomes did improve.

The success of the "Issue Team" concept, for example, grew into a formalized teaming strategy that included chartering teams, coaching, planning and assessment tools, and satisfaction surveys. As the concept of using multi-disciplinary teams representing broad perspectives and expertise became normalized throughout the agency, the formalization of teams has relaxed. It is now standard practice to create teams that address issues ranging from identifying short-term, discrete resource solutions to long-term, landscape-scale standing teams (teams that persist and work collaboratively for several years or longer).

Another expectation from leadership is integrative project planning. A visible win to lower- and mid-level staff was the creation of "Taxa Team Coordinators" to guide integrative project planning. These coordinators are charged with creating forums to share information, generating a common understanding and agreement on the most pressing conservation needs of their taxa group and recommending solutions to address them.

Each FWC division and many offices have employee awards or recognition programs; all of them include some recognition for exemplary teamwork. Several also include recognition for external partnering or collaboration which reinforces that FWC values these new behaviors.

Consolidating Change and Producing More Change

As the credibility for the new way of operating grew internally, FWC wanted to change all structures, programs and policies that did not fit the transformation vision. Of keen interest was improving the way the state agency received input from stakeholders. Soon after the restructure, leaders sought ways for reinvigorating stakeholder involvement with new projects, themes and change agents. One visible manifestation of FWC's commitment to gaining input from and involving stakeholders was contracting for the full-time services of an associate scientist at the University of Florida to organize stakeholder meetings, large and small, across a variety of important conservation issues in Florida. This individual is an effective change agent within FWC, working with the SLT and many state and regional staff.

Stakeholder meetings on more focused topics demonstrated FWC's commitment to identifying and understanding stakeholder concerns. These included: Marine Fisheries Summit (November 2004), Future of Hunting Summit (August 2005), Wildlife Action Plan Forum (June 2007), Freshwater Fisheries Summit (October 2007), Climate Change Summit (October 2008). Several advisory boards were created to work with staff on an on-going basis to discuss issues, resolve user conflicts, and propose research and management priorities. These and numerous smaller issue-specific meetings with stakeholders help FWC assess and address public interests and promote accountability. As the expectation of increased stakeholder engagement diffuses through the agency, requests for new skills in this area have increased. A meeting of about 50 staff was convened in 2008 to capture lessons learned on stakeholder engagement experiences, resulting in a stakeholder engagement manual. The need to better understand stakeholder concerns is leading to increased understanding of and desire for human dimensions insight via social science research

Examples of successful stakeholder engagement, including the attendant challenges and lessons learned, have been widely communicated internally and externally. A good example is the creation of parallel teams of staff and stakeholders to address management of the gopher tortoise, a threatened species that is significantly affected by development. The original large staff team was reconfigured after formulating basic background parameters and the scope of issues of concern. The second smaller staff team, known as "GT2," and a stakeholder technical assistance group (TAG) met over many months with formal facilitation and clearly defined governance. This combination succeeded in reconciling staff and stakeholder concerns, bringing many controversial issues to closure. When a proposal for gopher tortoise conservation came before the Commission for approval, the stakeholders, while not in complete support, were willing to accept the consensus of the team and work within the approved framework to continue the process. A subsequent staff team (GT3) and continuing stakeholder TAG is now implementing, monitoring and adapting the agreed management actions. While this model of stakeholder engagement required investment of resources not appropriate for every issue, it demonstrated to staff and stakeholders a new way of doing business.

Mid- to senior-level leaders in FWC are expected to continue to explore private-sector best practices for performance improvement. Books by leading experts on the subject (e.g., Stephen Covey's works on leadership principles, Kotter's [1996] *Leading Change,* Collins' [2001] *Good to Great* and others) were required reading early in the change effort. It is now common for mid- to senior-level leaders to have current private-sector management and leadership books share shelf space with classic natural resource management texts and scientific and professional journals. For several years, annual SLT retreats were focused on evaluating the execution and success of FWC change efforts; monthly SLT meetings continue to assess new behaviors.

Anchoring New Approaches in the Culture

The FWC is keen to improve performance with respect to stakeholder-oriented behavior, more and better leadership and more effective management. The change efforts to date have been largely successful in part because staff in a change-support office were specifically tasked to design, execute and assess the change efforts. A major focus in this office is to research, assess and deploy performance improvement information and methodologies. To keep the transformation of FWC energized, FWC leaders also turned attention to hiring, promoting and developing people who can implement the change vision. Broader, integrative thinking styles are more prevalent in criteria for promotion and hiring decisions than just a few years ago. People with the ability to lead agency change are identified, groomed and trained for succession. This was exemplified recently in several promotions into leadership positions; for example, FWC's new Executive Director and Assistant Executive Director embrace and model the characteristics of transformative leadership expected in FWC. Additionally, FWC recently signed a memorandum of agreement with a major university to access expertise important to FWC transformation and help develop potential FWC employees who are prepared to lead conservation of fish and wildlife in a rapidly changing natural and social environment.

Professional development for FWC staff comes in many forms (e.g., National Conservation Leadership Institute, MAT training modules, FWC's own Leadership Development Program). For example, one effort designed to facilitate the on-going change process is "Thinking Like a Manager" training, created at the request of FWC specifically to encourage systems thinking and the integration of biological/ecological and human dimensions considerations in fish and wildlife conservation and management. The trainings and follow-up consultation provided to graduates are intended to develop leaders as "coaches" in management thinking. More importantly, three cohorts of leaders (currently 26) who have taken this and other training are rising throughout the branches of the agency, prepared to provide adaptive leadership into the future. A coordinator was selected from among respected FWC staff to ensure the coaches stay connected regularly, serve as instructors in training sessions and work together on projects. These coaches demonstrate facilitative leadership, thereby modeling several desirable qualities for a vibrant, relevant and effective conservation agency.

The restructure of FWC alone was a major change; afterward the agency could have just settled into new "silos" and stabilized. FWC leaders recognized that would quickly lead to obsolescence, so they have worked hard to maintain the momentum and instill a culture of continuous improvement (i.e., adaptive change). There is a palpable, growing acceptance that the new way of doing business at FWC is managing and leading continuous change. This is codified in the agency's strategic plan, and FWC now expects staff to behave in ways consistent with it. The FWC transformation is an on-going change process; if it is successful, adaptive change is likely to be a distinguishing trait of FWC for the foreseeable future.

Management Versus Leadership Versus Transformative Leadership

As the Florida case illustrates, the driving force behind strategic change in a SFWA is leadership. Fundamentally, leaders and particularly those in senior leadership positions have the authority to make agency transformation a top priority and guide development of a vision leading to goal expansion. Leaders are critical components of successful organizational transformation. A leader can take either of two approaches to leading change in an organization—they can be responsive (i.e., iterative and incrementally adaptive) or strategic (i.e., innovative and transformational). We have observed several approaches to change taken by SFWA leaders, but they seldom reflect transformative leadership. We can turn to Kotter (1996) again to shed some light on why this may be the case.

Management Versus Leadership

Kotter, like many others who have studied ingredients for organizational effectiveness, distinguishes between management and leadership as follows (Kotter 1996: 25-26): ***Management***: planning and budgeting, organizing and staffing, controlling and problem solving. Produces a degree of predictability and order that is comfortable for many people in a bureaucracy; produces short-term results expected by various stakeholders. ***Leadership***: establishing direction, aligning people, motivating and inspiring. Produces change, often to a dramatic degree, and has potential to produce extremely useful change for ensuring future of an organization. Kotter (1996) asserted that many organizations have more management than leadership capacity. As a consequence, many people in decision-making roles frame the problem of "pressures to change" as the need to "manage change." Kotter (1996: 29) concluded that, "The combination of cultures that resist change and managers who have not been taught how to lead change is lethal."

SFWAs face many impediments to transformation, including significant political interference and strong traditional ties to consumptive stakeholders who may be concerned with implications of change. To overcome these, effective leaders must be the transformative type. That is, courageous individuals who (1) are not afraid to buck long-standing elements of an institution; (2) can weather heavy criticism; (3) will risk termination; and (4) will accept probability of failure in pursuit of major beneficial change. This type of leader approaches change as an intellectual activity more than as an action (i.e., empowers others who can lead and manage the specific changes that enable transformation). This type of leader is effective at garnering the support needed to be successful. A transformative leader possesses knowledge and technical skills, *plus* the wisdom and talent needed to envision and lead large change.

Managing Change Versus Leading Change

Purposeful transformation of an organization can happen incrementally or abruptly. Incrementalism, though common, is *minimally adequate* in times when the context necessitating transformation is evolving slowly. Incrementalism is *inadequate*, however, when (1) the context is changing very quickly or (2) the rate of organization change has been lagging the rate of context change to the point that the organization has fallen considerably behind expectations of it. Depending on many factors, a SFWA may be in either situation "1" or "2." In either case, one doesn't *manage* an agency out of the situation—one *leads* an agency to a desired future condition. If the chasm has been allowed to grow too long and has become too wide, a giant leap—a transformative change—may be required.

"*Don't* be afraid to take a big step. You can't cross a chasm in two small steps." (David Lloyd George, ex-British prime minister)

Competent management and normal leadership may be called upon to achieve the change, but transformative leadership is vital to identify what the agency is going to *transform into*. Someone has to imagine or create and guide the coalition that will provide a vision leading to goal, boundary and activity transformation. But leaders do not make transformative change by themselves; other people are needed to make the vision a reality.

Management, normal leadership and transformative leadership are all necessary to achieve agency transformation. None are sufficient by themselves or in couplets. The roles are complementary:

Management is an action-oriented practice, involving processes, resources and technology to execute well. Some people are trained and skilled at it. Good management involves consistent application of processes and progressively more efficient work. Management is focused on doing things right.

Normal leadership is an outcome-oriented activity, with the most significant aspects being analysis, decision making and communication. It is less about ever-more efficient processes and more about better outcomes. Normal leadership is focused on doing the right things.

Transformative leadership is largely an intellectual exercise, focused on helping people envision a desired future, articulating that vision, gaining a broad coalition of support for it, engaging that coalition to work toward that vision as a shared goal, and empowering other leaders and managers in the organization to focus on the vision. It is about overcoming the inertia of dependency on historical rationales and premises, relationships and understandings, methods and outcomes. It is focused instead on creating a vision that is so compelling and attractive that it becomes a movement powerful enough to break the shackles of the past and surmount the barriers of the present. Transformative leadership, therefore, is focused on encouraging others to imagine what might be an unimaginable future to them at first, and then aiding them to embrace and work toward that future.

Thinking of organizational transformation as a journey, our view of the relationship of management, normal leadership and transformative leadership goes like this: management maintains the gyroscope, normal leadership keeps an eye on the compass, and transformative leadership defines the destination. Transformative change needs all three components, but will not occur with just the first two components, *or* with just the last one. As DeGenring (2005: 2) put it: "The question is no longer, 'How to manage change?' The question now is, 'How to *lead adaptive change*?'" DeGenring (2005: 47) described adaptive leadership as:

- reframing the leader's job from that of problem-solver to that of development of problem solvers;
- leading the examination, testing and changing of assumptions;
- asking the important, tough questions while not having all the answers;
- fostering appreciation of different points of view;
- fostering reflection and big picture thinking;
- allowing awareness, visibility and reflection of each other's thinking and reasoning;
- encouraging more innovation and learning;
- slowing down to move the action forward; and
- demonstrating and modeling courage.

Note that key traits of adaptive leadership are coaching and empowering others.

Taking the First Step: Assessment of Agency and Leadership Capacity

We and many others (Heberlein 1991, Manfredo et al. 2003, Patterson et al. 2003, Gill 2004) have argued that because the social context has changed significantly since the origination of the state fish and wildlife management institution, which emerged in a particular social context (i.e., particular values, interests, needs, etc. at a particular time), SFWAs must change as well. If SFWAs do not reflect broad societal norms and values of contemporary society, it is likely that their legitimacy will be questioned by society, and their long-term viability will be uncertain (Scott 2001).

If the distance grows between what SFWAs are now versus what they need to be for the future, it seems that the people in leadership positions who recognize the widening gap must wonder, *when* do we need to change? As pressures for reform mount, at different paces in different places, the answer often becomes obvious. Perhaps the eight mistakes identified by Kotter (1996) have already been made by some SFWAs, so they accept the need to pursue a change process such as we presented in this paper. But then what? What will launch a SFWA on the journey of transformative change? By way of review and summary, Kotter (1996) offered two sets of traits to consider; one set refers to the "change-ready" agency and one to the "change-making" leader (or leadership team).

Traits of a change-ready organization (Kotter 1996: 161-173):

- a persistent sense of urgency;

- teamwork at the top;
- people who can create and communicate vision;
- broad-based empowerment;
- delegated management for excellent short-term performance;
- no unnecessary interdependence; and
- an adaptive organizational culture.

Obviously, it takes skilled leadership to create the conditions indicated in the change-ready agency and to execute the eight-stage process of transformative change.

Traits of a change-making leader (adapted from Kotter 1996: 183):

- risk taking—willingness to push oneself out of comfort zone;
- humble self-reflection—honest assessment of preparedness and performance;
- solicitation of opinion (inquisitiveness)—active collection of information and ideas from others;
- careful listening (receptivity)—propensity to listen to others; and
- openness to new ideas—willingness to view situations with an open mind and to consider alternate paths to achieve a desired future condition.

Thus, even if we do not need to manufacture more leaders, we may need more training of existing leaders to help them adapt to a rapidly changing environment and new reality for SFWAs. We need large-scale mobilization of expertise for transformative change, and continual adaptation to emerging challenges and opportunities. In the National Conservation Leadership Institute training program they refer to this as leadership for adaptive problems, similar to DeGenring's (2005) notions of adaptive challenges and the adaptive leader.

As DeGenring noted, transformative change and adaptive leadership are likely to encounter pitfalls. For a variety of reasons, leaders today in SFWAs may encounter risks if they pursue certain directions for change. We feel this is especially probable given the governance structure, external politics and internal cultures of many SFWAs. Our own study suggests that it is likely essential that SFWAs first promote understanding and acceptance of the need for organizational transformation internally and with traditional partners and policy makers, including governing commissions and boards, before setting transformative change efforts into motion.

Conclusion

We conclude this paper with a question: is it possible that the largest barrier to launching a transformative change process is the *will* to do so? Resistance to change is attributed to myriad causes, but denial, deferral and indecision seem to be the prime suspects. Furthermore, we urgently need a more comprehensive vision of fish and wildlife conservation that is galvanizing rather than polarizing, that produces solidarity rather than divisiveness among stakeholders. That compelling, inclusive vision needs to be discovered and then serve as the destination to motivate SFWA transformation. Certainly the innovations toward transformation exhibited by Florida and some other SFWAs are guiding lights in their own right. We need to take the time to learn about what they are doing and how they are doing it. Then we need leaders to help other SFWAs take the first step toward transformative change.

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Transformation of State Fish and Wildlife Agencies: Challenges and Opportunities for Leaders

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A conversation about organizational transformation—particularly in state wildlife agencies—should hold a sense of urgency for all of us. I do not mean frenetic activity, a lot of folks running from meeting to meeting trying to cope with a dozen issues at the same time. Instead, I mean something similar to what John P. Kotter, Harvard's famed author of *Our Iceberg Is Melting* (Kotter and Rathgeber 2006), and noted authority on leadership and change describes. Kotter says that "Urgency is driven by a deep determination to win, not anxiety about losing." For some of us, the mere thought of the challenges associated with transformation of our agencies is overwhelming. As we have heard and inherently know, transformation means fundamental *change,* and change means living through and into another way of doing business. For some, that leads to anxiety. But for others, transformation leads to timely opportunities.

Transformation, then, is that which we need to embrace, for it can bring about an outcome we are all deeply determined to achieve: an unwavering, sustainable future for conservation of fish and wildlife. So, what does that mean for state fish and wildlife agencies, and how do we set the foundation for organizational transformation? I would like to talk about laying the groundwork from an aerial view, a global perspective, if you will, and then take you to a more specific level and detail some suggestions that you may choose to practice in your organizations.

Transforming an Organization Means Transforming People

First, let's recognize and agree that an organization is a human community. Those who study state fish and wildlife agencies consistently use terms in their research that clearly underscore this: human dimensions, societal context, relationships, primary groups, and so on. Working with humans is a daunting task, but it is an absolute necessity to *understand* them. Failure to rethink and reevaluate our "enterprises" from a humanistic approach will give us little respite from our current challenges. Whether we are talking about "visionary," innovative," "adaptive" or "transformational" organizations, we need to address the leadership of change, or transformation, from a "human" perspective.

Leaders as change agents in state wildlife agencies need to take a long look at the governance structure—the organization as a top-down hierarchy as is typical in most state fish and wildlife agencies—and move toward as Dan Decker and others suggest, "… wisely managing the sharing of responsibility for wildlife conservation with stakeholders." We implemented this notion as a change in how we do conservation business in Michigan's Upper Peninsula (UP).

We have two UP citizens' advisory councils—one to help us with conservation issues in the eastern UP and one for the western half of the UP. These have been hugely successful both in helping us identify emerging issues and in helping us "share the responsibility" of managing areas of concern. We will be replicating the UP citizens' advisory councils throughout Michigan.

Encouraging the Leaders among Us at All Levels

Another view of transformational leadership is that leaders of change are not only those "at the top," or the senior executives. Most of us are familiar with top-driven changes—they do little to remove distrust and do much to inhibit creativity and constrain the quality of thinking in the agency. Leadership comes from many people at many levels. Building this capacity at multiple levels helps shape the future of the organization.

I believe there is a disconnect between fish and wildlife managers who approach their work as scientists and their publics or stakeholders. Taking a scientific approach, we tend to look for trends and patterns, too often largely from a computer or from our office cubicle. Our tendency to reduce complex issues into more simplistic

terms, sometimes to the point of minimizing them, impedes our ability to see the system comprehensively. Our stakeholders, on the other hand, know the landscape in and out, and up and down. They have a holistic understanding of the resource. It may not be complete, and sometimes it is wrong, but they are grounded in what they believe to be true. This difference between agency staff and our stakeholders creates tension.

Leadership really manifests in the capacity to hold creative tension—energy that is generated when people challenge each other and the status quo. I think the transformative leaders at many different levels of our agencies are the ones to reconnect science and stakeholders in a fashion that is meaningful and non-condescending.

We must not forget the "line" employees, those in the local areas with accountability for results and the responsibility for how work is implemented, who are often very capable to serve as leaders. They are vital to effective change. Now, that's not to say that the executives are not part of the transformation process. They frame the organizational structure for continual creativity, knowledge transfer and generation, and leadership by example.

Shifting Organizational Gears and Synchronizing with Human Values— Managing Versus Being Run Over by the Train

Using all of our collective abilities, we must also recognize that organizational transformation has to take into account inner shifts in people's values and behaviors with "outer" shifts in processes, strategies and systems. Given this premise, I think it is most important to remember what organizational change pioneer Richard Beckhard said, "People do not resist change; people resist being changed."

I believe part of the groundwork for organizational transformation must include a compelling vision that can be effectively communicated and understood internally and externally … a vision that will induce people who want to change because it is consistent with their values and aspirations. As our Workshop chairs Cindi Jacobson and Dan Decker pointed out, one of the first steps for state wildlife agencies to take is to broaden our goals … a goal expansion, that is, that ultimately results in cultural change. In Michigan, that step seems more like a giant leap, as I bet it would for most of your agencies.

After all, we are proud of our natural resource management heritage and our rich institutional history. These roots give us a sense of security and direction— our historical grounding we take with us as we walk toward the future. And making a cultural shift, changing tradition, is no easy task. But, as Dwight Eisenhower said, "Neither a wise man nor a brave man lies down on the tracks of history to wait for the train of the future to run over him."

In the Michigan Department of Natural Resources and Environment (Michigan DNRE), that train is picking up speed. We've expanded some of our goals for the sake of wildlife conservation, including broadening our audiences … not discounting our traditional stakeholders but attempting to bring in a wider range of "customers." And, for many of us, thinking in terms of customers is itself a cultural shift.

Transformation in Michigan

Let me share some of the leaps we've made in Michigan that illustrate what I mean, briefly touching on three examples: sturgeon spearing, performance requirements for our wildlife biologists in the field, and the use of social media.

Sturgeon spearing, a coveted recreation in Michigan, took on a different dimension this winter when our regulations were creatively modified. In February of this year, we expanded our goal of lake sturgeon fishery management by replacing a system used in recent years that required anglers to draw for permits and limited the number of participants. Working closely with one of our stakeholder groups, Sturgeon For Tomorrow, we established a shorter season on Black Lake where anglers were allowed to participate at will, eliminating the special drawing-based system.

In other words, all anglers who wanted to try their hand at sturgeon spearing were able to do so. They had to register on site the day they planned to fish and were required to register immediately any sturgeon

speared. Sturgeon season was slated to run from February 6 through February 10, or whenever the quota was reached—whichever came first.

It took just 30 minutes into the second day of the season for anglers to harvest the five sturgeon quota from Black Lake. (Anglers took four fish during the first six-hour day of fishing.) We registered 255 anglers for the opening day and 169 on the second day.

This innovative goal expansion not only continued to protect the sturgeon population from over-harvest, it also increased customer participation and satisfaction. As our biologist on site said, "We received nothing but positive comments."

A second example of a "new way of doing business" and a cultural shift toward transformation is a fairly new requirement for all field wildlife biologists. Michigan has an enormous public land base that, as you can imagine, takes a lot of time to manage—so much so that we often overlooked private landowners as our customers—not for any reason other than we just didn't seem to have enough time in a day to concentrate on private land management. After taking a fresh look and brainstorming about how to increase our customer base in this arena, we took a bold step and decided that every wildlife biologist who works in the field will devote at least 12 percent of their time to private lands management. This goal expansion embraces diversity by considering all lands for wildlife management. This change in performance factors also forges a reconnection with those who are closest to the changing landscapes—the landowners. Over the years, our publics have become less engaged with science, so we run the risk of losing the ability to have traction toward communicating the value of conservation. By incorporating private land management as a requirement, it helps us stay grounded with our customers, moving from a less regulatory atmosphere to a more social one.

A third and last example I'll talk about, something all of us here must get on board with in transforming state wildlife agencies, is social media. Talk about culture shock! I can look around and guess that few of us have a fan on Facebook, tweet on Twitter or have had a story published on Digg. Well, according to a study from last July by social media marketing specialist, Lyndon Antcliff, 18- to 34-year-olds now spend 4.3 times more time on social media than with TV, radio, newspapers, magazines and books combined. This is happening because social media allows users to talk to each other and choose for themselves what they see and read. This conversational aspect of social media is crucial to understanding social marketing. The Michigan DNRE has ventured into social media, and since last April we already have 2,500 followers on Twitter and more than 2,700 on Facebook. This is an exponential growth in awareness of our issues. It's a new way of interacting with stakeholders and engaging in conversations with brand new audiences who may not otherwise be engaged, with untold numbers from the trickle-down effect of additional social networks. Michigan DNRE news finds itself on Web pages of followers from around the world! Social media is popular because it promotes dialogue and allows individuals to share experiences with others, and people trust real life experiences. Social media is a many-to-many conversation and not a one-to-many communication. State wildlife agencies need to delve into the many-to-many conversations and talk about real life experiences that can and do happen because of what we do in conservation. Take the leap!

It's a Risky Business

Transformation does not come without risk, discovery and inevitable limitations. It has been said that "Every movement is being inhibited as it occurs. This is nature's way. We can either work with it, or work against it." I strongly suggest we work with it.

Here, then, are some thoughts that you may be able to use to help build a foundation for transformation in state fish and wildlife agencies:

- Full commitment from leadership. Prioritization of transformation at the highest level within your agencies is the first essential step.
- Transformation takes time and energy. Establish a core group sincerely committed to organizational re-engineering, restructuring and rebuilding.

- Ask those who are interested in organizational change—one with no "hierarchical" authority—to call a meeting to discuss the transformation. This informal social network works well for those who are genuinely interested and will respond in the positive.
- Tackling fundamental change requires time for thought and reflection. "Clear the plates" of those interested in bringing about change to enhance "possibility thinking" and allow them reasoned focus.
- Allow these informal networks to build momentum—"Organizations are webs of participation," said John Seely Brown, Co-Chairman of the Deloitte Center for the Edge and former Chief Scientist of Xerox. They have a common purpose built from a common ground and will learn exponentially from each other.
- Strengthen your communication efforts, which means financially fortifying your education, outreach and marketing efforts. The ability to share information with and gain insight from your employees, stakeholders and interested citizens is crucial in building support for organizational transformation.

Traditions are Valuable, So Create Some New Ones!

As I mentioned earlier, our agencies are steeped in tradition, and we love that. We should. Our history tells others who we are and where we've been. It's time now to create new traditions via goal expansion. Let us not lose confidence in what we know, but let the sound science we believe in combined with inclusion of more interests in wildlife conservation lay the groundwork to transform our agencies, so our passionate intensity about nature will live on. The old saying, "timing is everything," couldn't be more appropriate.

This is our time, folks, so let's roll up our sleeves and, with deep determination, lay the first stone of transformation in state fish and wildlife agencies across the nation. Let's do our best to keep up the good work of all those fish and wildlife managers and conservationists who came before us. We owe it to them, to ourselves and to all those who will follow. Perhaps most importantly, we owe it to the citizens who place their trust in us to meet their expectations for fish and wildlife conservation and management.

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Expanding Scope and Depth of Influence:
Broadening the Beneficiaries of State Fish and Wildlife Agencies' Conservation Activities

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Historic Role of State Wildlife Agencies—What is Our Basic Core Mission?

The mission of the Arkansas Game and Fish Commission is to manage wisely all the fish and wildlife resources of the state while providing maximum enjoyment for the people. This is essentially the same as all state fish and wildlife agencies (SFWAs). It should be a familiar line to all of us. But what does this really mean? Is our mission specific to hunters and anglers, those that buy our licenses and permits and have been our primary funding source since most of us began our careers? Or is that a narrow view, no longer sufficient for our agencies to remain relevant and vital to the citizens of our states?

We have heard and read about Theodore Roosevelt, George Bird Grinnell, Gifford Pinchot and many other conservation leaders of the early 20th century who created, molded, and bequeathed us with the conservation model that we follow and manage today. These pioneers in conservation averted the extinction of many species of wildlife that Americans enjoy today and we manage in trust for them and future generations, but the early years of fish and wildlife conservation were fraught with challenges and near misses.

The turning point for fish and wildlife across the country and for Arkansas came at about the same time. As these aforementioned champions became aware of the decline of fish and wildlife populations across the country and began taking extreme measures to correct the problems, the people of Arkansas were vocally reacting to the plight of wildlife in a similar manner. Our Commission was established in 1915, and we spent the next 75 years restoring wildlife populations all across the state, funded solely by hunters and anglers. In Arkansas, and likely in every other state, those of us staffing SFWAs have been much like the folks we have been working for, hunters and anglers. We were raised in families or spent our childhoods in communities where these outdoor activities are traditions. The cultures of our agencies largely reflect the cultures of the people who buy the licenses we offer. That has been a source of strength for our work because our values and those of our traditional stakeholders have been virtually the same. But the times are changing rapidly and, subsequently, the interests in wildlife conservation and management and expectations for SFWAs are increasing.

After nearly a century of doing business in a way that worked well for wildlife and a constituency that has been vested in conservation from the beginning, it is a time to make a major assessment of how we are doing in the eyes of a broader set of stakeholders. Are they benefitting from our conservation efforts to the extent they should or could? If not, why not? Are our individual values and agencies' cultures blinding us to new opportunities to serve more people, to be more relevant and vital?

These are difficult questions to consider, but if we do not find a way to change our culture to better reflect that of society, we will be marginalizing our chances for securing alternative funding. That means we will be hindering our ability to continue our role as leaders of fish and wildlife conservation. There are exceptions, but most of us realize there is a growing disconnect between much of what our agencies do and the interests of citizens in our states. Nevertheless, it's easy to be complacent because we (SFWA employees) are part of the traditional constituency so we may have difficulty assessing the interests and demands of those who are not. We know how to satisfy ourselves (what we need and how to produce it); therefore, any expansion of goals will require extra work as well as moving away from our comfort zones. Overcoming those sources of inertia will be no mean feat. And some make convincing arguments that change is unnecessary or benefits from fish and wildlife management desired by those who do not fund conservation are undeserved. That viewpoint reflects a particular interpretation of the mission of SFWAs.

So, what is our basic core mission? Is it the same as it always has been? If not, are we learning to adapt to survive and produce the benefits society seeks from our efforts? What have those agencies that have undergone transformative change actually learned, and can our lessons be helpful to others? These are the questions we are exploring in this workshop. I have a few points to share based on our experience in Arkansas. You can be the judge of their applicability to your state and your situation.

Is There Demand for More?

Although the Arkansas Game and Fish Commission has successfully secured additional conservation funding, it was an adaptive learning process from the beginning. We began the process in 1983 with agency employees collecting the necessary signatures to place the funding proposal on the ballot in the 1984 election. Once the measure was on the ballot, we expected it to win with the support of the folks that knew who we were and what we did (our stakeholders at the time). We took for granted that there were many other folks out there who did not know who we were or what we did, and would not support raising taxes for our conservation work. The initiative failed!

Twelve years and three tries later, we successfully passed a conservation sales tax. After going it alone and failing the first two tries, we figured out that we needed votes other than from our stakeholders to win this initiative. We knew we had to make some major changes in our thinking, our approach, our message and our communication of it. And we did.

Three actions that we took gave us our success. First, we partnered with Arkansas State Parks and Tourism, the Arkansas Department of Natural Heritage and a small new Commission called Keep Arkansas Beautiful. The one-eighth of 1 percent would be divided among the four agencies; 45, 45, 9 and 1 percent, respectfully. This partnership allowed us to tap into the votes we couldn't get before. Second, we conducted a survey and asked the public (not just hunters and anglers) how they would like us to spend the new money if the tax law passed. Last but not least, we hired a campaign manager/fundraiser to focus on coordinating the activities across the four agencies. She was the heartbeat of our collaborative initiative. She taught us to communicate in a way we never before imagined. The fact is if we wanted to get more, we had to give more. If we were to garner broad public support, we had to identify the public's needs (through a public opinion survey in 1994), promise to address them and convince them to trust us (through a Plan for Conservation, 1994). Then, when we secured the funding, we had to fulfill our campaign promises. Upon reflection, it was a rather simple, common sense model. It just wasn't what we were accustomed to doing, especially reaching out to new stakeholders; that was uncharted territory.

Should we be doing more to understand the public's interests? The answer is simple, don't make assumptions, find out. Not only do we need to know for sure if there is a demand for additional programs and services, we need to know what that demand is and who is expressing it. Staff time and financial resources are too precious to make assumptions based on our vaguely formed opinions or what we believe to be true in the absence of systematic inquiry, only to find out later that we were wrong.

New Programs and Creative Delivery—
Reaching People with Nontraditional Interests and People Who Do Not Know We Exist

In the Plan for Conservation, we laid out how we would spend our share of the new tax revenue. I believe it is fair to say that our new stakeholders (not hunters and anglers) were probably paying more attention to what we did after the money came to us than were hunters and anglers. The expectations of our stakeholders were much different; they were getting something new as opposed to more of the same. They wanted to see results—innovative programs that were directed to their needs and interests.

We promised and built four nature centers. We expanded our education division, added nongame biologists and had partners we had never worked with before. Essentially, we became the "cash cow" for conservation in Arkansas. We were and still are the "go-to" agency for many potentially new partners who brought novel ideas to our attention. Recently, we completed a public opinion survey where the results showed that more than 70 percent of the public loved us, but less than half knew who we were. We need to work on our identity recognition, but we are doing so from a position of strength. A positive image is ours to develop.

Accountability

How important is accountability really? Very important. In this democratic society, even though our missions are based on the high moral ground of sound conservation, we are still accountable for our actions and the responsible use of public funds. Furthermore, we have a responsibility to fulfill our public trust role with high standards and effectiveness. We must put forth our best effort to manage our natural resources to meet stakeholder-defined outcomes, using sound science and best practices.

Accountability today is quite often based on perception. In most cases, perception is reality in a political sense, and despite all the science we might muster, SFWAs operate in a political environment that is consequential. We had better put our best foot forward and be open and transparent. Public opinion surveys have to be repetitive to monitor and measure our success. We have to, at some point, stop thinking entirely like biologists and market our work to those who support it. First we need to perform, then we need to be sure that good performance is widely recognized and appreciated. We really do offer the best public service in town!

Summary

For SFWAs to flourish and provide the conservation services needed by current and future generations, we have to adapt. Today, that means many of us need to engage in transformative change. We absolutely have to expand our scope and depth of impact, but we have to do it strategically. We have to examine our priorities against those of the citizens for whom we are entrusted to manage fish and wildlife resources (all citizens, not only consumptive stakeholders), and adjust as necessary. We should not neglect any stakeholder group, traditional or new.

SFWAs across the country are changing their complexions as we speak. Cornerstone biologists either have recently retired or are heading in that direction. The new generation of biologists out there today may not be any smarter, but they surely have a different way of thinking and doing things. They are not asking why, but why not. The days of doing conservation the way we think it should be done without being informed by and informing the public are over. Even the North American Waterfowl Management Plan is undergoing change. At its inception, the most important things were habitat and populations; however, today, the needs of the users are finally being considered.

The North American model of wildlife conservation need not be compromised by change and expansion of beneficiaries. If not interpreted too narrowly to fit past contexts, it can remain the backbone of our agencies. The model's basic tenet that our fish and wildlife are to be managed in such a way that their populations will be sustained at optimal levels forever are exactly what Theodore Roosevelt, Aldo Leopold and all the other conservation heroes have told us. We must do whatever we need to do to meet the needs of today's citizens, but we should not ignore the traditional stakeholders who have contributed much to create the strong foundation of fish and wildlife conservation that has sustained SFWAs for most of a century .

After 95 years, The Arkansas Game and Fish Commission is finally developing a strategic plan. One might wonder how we got this far without one. It's pretty simple, we were all busy making sure we had critters to hunt and fish and a place to do it. Today, the paradigm is changing; there is a demand from our new, nontraditional stakeholders that is creating many opportunities that we need to address.

If we can truly change the way we think and communicate, if we can educate and understand the new stakeholders and meet their needs, we will all be able to secure the funding we need to be a better agency for tomorrow. The past Chairman of our Commission, Freddie Black, once made a great statement to his fellow commissioners in a debate while trying to convince them to purchase a piece of property. He said, "we are in the forever business," and I couldn't agree more.

The Importance of Partnerships in a Time of Transformation: Perspectives from Nongovernment Organizations

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Wildlife conservation in theory and practice is already undergoing an unprecedented and accelerating transformation (Jacobson and Decker 2006, Peyton 2000, Organ and Fritzell 2000). Some predict that the next 50 years will require major reforms in the principles and practice of wildlife management and conservation (Adam 2006, Millenium Ecosystem Assessment 2005). The entire conservation framework has been shifting from an agricultural paradigm to an ecological context (Lancia et al. 1996). Conservation theory itself is transforming as technology and science advance and challenge our traditional understanding of ecology and biology. Although we are closing the gaps on biological uncertainty, we are discovering new layers of ecological and sociological complexity. This shift in conservation theory and practice is requiring both government agencies and conservation nongovernment organizations (NGOs) to exercise some ability to forecast, understand the consequence of change, adapt conservation strategies and reinforce critical partnerships. In other words, like it or not, we are already undergoing transformation together to meet approaching challenges. We will be far better able to cope with transformation by developing strong partnerships united around common values and beliefs than by independent actions.

Building partnerships to meet approaching challenges and manage our natural resources depends on strong leadership that understands diverse perspectives and facilitates cooperation among stakeholders. This requires leaders that are skilled at building healthy relationships, increasing communication pathways and finding common interests among varied groups. Although many conservation leaders demonstrate a capacity to form effective partnerships, we believe that future leaders in the conservation community will need to do even more to grow meaningful partnerships and achieve our collective conservation goals. As we consider the topic of state fish and wildlife agency (SFWA) transformation, we will focus on the role that effective leadership and conservation partnerships can have in helping SFWAs conserve fish and wildlife resources in North America.

Partnerships: The Benefits and Challenges During Transformative Times

Organizational research has identified three primary elements for goal transformations: (1) changing the breadth of organizational goals, particularly evolution from specialism to generalism; (2) changing the domain served by an organization (boundary expansion); and (3) changing activities that have a significant effect on organizational knowledge (Aldrich 1999). Transformation in activities will typically involve the creation and diffusion of innovations due to the introduction of new technologies or management systems, as well as changes in the availability of resources. In this paper, we focus on the importance of boundary expansion to SFWA transformation. We emphasize how strong and meaningful partnerships can expand the membership and broaden social participation in a conservation program or project, helping wildlife agencies further their conservation efforts. We will also briefly discuss important challenges to forming enduring partnerships.

Goals and Conservation Targets

Partnerships can help organizations such as SFWAs and NGOs innovate, consider new ideas and summon new visions for conservation. Critical first steps to forming partnerships are opening communications to allow the sharing of

perceptions and views, and identification of common ground. This can help the partner institutions broaden their traditional perspectives and transform conservation goals and targets to meet future conservation challenges. Conservation NGOs have brought many new ideas to the table that have been adopted by many SFWAs and, as a result, healthy partnerships have been formed to explore new conservation theories and improve conservation practice. Examples where NGO initiative encouraged new conservation ideas in theory that transformed into conservation practice include:

- Biodiversity hotspots (Environmental Defense Fund)
- Reintroduction and Restoration of Endangered Species (World Wildlife Fund [WWF], Turner Endangered Species Fund)
- Restoring species to the full extent of their historic range (Rocky Mountain Elk Foundation[RMEF])
- Ecoregion Based Conservation (WWF, 2 Countries-1Forest,The Nature Conservancy [TNC], Wildlife Management Institute [WMI])
- Managing for Ecological Integrity and Sustainability. (TNC, WWF)
- Conserving Ecological Connectivity (Western Governors Association [WGA], Freedom to Roam [FTR], Wildlands Network)
- Climate Change Adaptation Initiatives (National Wildlife Federation [NWF], WWF, Association of Fish and Wildlife Agencies [AFWA])

Conservation NGOs can also bring practical guidance for innovation to SFWAs through stakeholder relationships, workshops and printed thought. Technical expertise from Conservation NGOs has been and continues to be invaluable to organizations considering new strategies or approaches for conservation of species and habitats. Examples include:

- Drafting a Conservation Blueprint by The Nature Conservancy (Groves et al. 2002)
- The Science of Conservation Planning by World Wildlife Fund (Noss et al. 1997)
- The Society for Ecological Restoration--primers on ecological restoration (Clewell and Aronson 2007)
- Large Mammal Restoration (Maehr et al. 2001)
- Predators and Prey Relationships (Safari Club International [SCI], WMI)
- Eastern Elk Management (RMEF)
- Voluntary Guidance to Incorporate Climate Change into State Wildlife Action Plans (SWAPS) (AFWA, NWF)

Often, NGO partnerships will challenge agencies, which can have both negative and positive outcomes. This challenge can be framed during conversation, in print, in public policy debates and stakeholder processes. However, many times, the challenge can identify and support a needed change in natural resource decisions, lead to mitigated solutions or even drive important institutional change. In most cases, these challenges actually lead to successful resolution, increased understanding among the partners and better conservation for all. An example of how conservation NGOs might provide important challenges to SFWAs through printed materials include the recent work produced by Sutherland et al. (2009) in which they asked representatives from 21 conservation organizations to identify a list of 100 questions that, if answered, would have the greatest impact on the practice of conserving biological diversity worldwide. This simple assessment by the conservation community has helped build a thinking framework for all agencies and organizations concerned about the future of conservation.

Many NGO partners can bring international experience and offer a global perspective to conservation (Redford and Grippo 2008, WWF 2008). The Wildlife Conservation Society's (WCS) Human Footprint analysis provides a unique perspective on human impacts worldwide, which can help SFWAs frame their own conservation picture. The WWF living planet index can improve our understanding of worldwide trends in conservation. A global perspective of a species' status and condition can encourage organizations to better manage priority species in North America (WCS 2008, WWF 2008). Safari Club International, working in partnership with three countries, has developed a program titled ZiMoZa (Zimbabwe, Mozambique and Zambia) which is a transboundary approach to conservation of natural resources in border areas. NGO experiences with other ecosystems, different socioeconomic situations and diverse cultures can enhance our understanding of North American ecosystems, contribute new ideas and approaches to manage social change, and inspire us to conserve species and habitats on our own continent.

Increasing Capacity and Expanding Boundaries for Conservation

Partnerships with conservation NGOs can catalyze and extend cooperation beyond the traditional constituency of a wildlife agency. Partnerships between agencies and conservation NGOs can expand the effective membership of both parties and enhance the political and educational power of each. One partnership with conservation NGOs can facilitate further networking with NGO partners. An example is the tremendous networking among many conservation NGOs, the Western Governors' Association and state wildlife agencies in the West to protect crucial habitat and wildlife corridors. Further, partnerships can lead to coalition building, such as with the Teaming With Wildlife (TWW) Initiative, which

increases political capacity and the likelihood of successful conservation outcomes. These partnerships and coalitions can enable transformation within wildlife agencies that could not happen without that cooperative relationship.

Although SFWAs have relatively stable and consistent funding for now, their ability to hire additional staff to meet growing public demands or to match federal money (e.g., State Wildlife Grants [SWG]) is a concern (Jacobsen et al. 2007). Partnerships can expand the funding base of wildlife agencies through direct financial cooperation and intensive financial leveraging of resources. Conservation NGOs have extensive experience working with granting foundations and, under the current economy, all are interested in leveraging and optimizing the value of their resources. An example of that is the recent program instituted between the Doris Duke Charitable Foundation (DDCF) and WCS. Together, they created the WCS Wildlife Action Opportunity Fund which supports State Wildlife Action Plan (SWAP) priorities. This program prioritizes projects in which innovative partnerships are formed to increase capacity and improve the likelihood of successful and lasting outcomes. The partnerships formed through this innovative funding approach have leveraged a relatively small amount of money ($5.2 million) into a larger sum ($10.6 million) for conservation.

Partnerships often can bring added capacity to wildlife agencies. Conservation NGOs can bring special talents and capabilities to a partnership and help build additional capacity within SFWAs as well. The result is that partners help each other become what Senge (1990) calls learning organizations. An example is the recent work on climate change happening across the world and in this nation. Recent guidance provided through a partnership brokered by AFWA resulted in specific guidance to help states incorporate climate change into SWAPs and other management plans (AFWA 2009). Many other conservation NGOs are actively supporting SFWAs' interest in considering climate change in management planning and conservation programs (NWF, WMI, Manomet). Conservation NGOs are able to assist wildlife agencies in conceptualizing and planning for new climate futures (Inkley et al. 2009)

The value of conservation education to communicate needs, challenges and successes is incredibly important for any organization or institution. As society becomes more urbanized and technology oriented, it is quickly becoming "informationally impaired" when it comes to conservation of species and habitats. Although many institutions and organizations are addressing this issue, there remains much to accomplish, and the work is never completed. Conservation NGOs may be less constrained when communicating to people about nature and can bring some unique messaging capacity to SFWAs. Many conservation NGOs have specialized capacity for outreach. For example, WCS owns and operates a number of zoos and marine aquaria where large numbers of youth can connect to nature in the only way possible given their urban circumstance. SCI hosts a program called the American Wilderness Leadership School where they concentrate on teaching youth and adult educators outdoor skills, wildlife management, conservation science and sustainable use. Many other organizations have very large memberships and extensive media capacity to carry a message beyond the boundaries of state or nation. As we play in a much more global society, the ability to reach a larger audience become increasingly important. Reaching a broader audience through partnerships in wildlife education can significantly influence and transform social thought relative to wildlife conservation.

A partnership between conservation NGOs and wildlife agencies can harness each group's power to exert political and policy influence to benefit conservation of species and habitat. Most conservation NGOs have some capacity to lobby and influence agency policy. There have been many examples of how that has worked effectively to advance conservation and transform politics for the benefit of wildlife. The most compelling case is the TWW initiative which remains a vital force in lobbying for expanded funding for fish and wildlife conservation and combines the lobbying force of more than 6,200 organizations to lobby Congress for increased resources so that SFWAs and conservation partners have funding to fully implement SWAPS (Franklin and Bies 1996). Other examples include the work by the Theodore Roosevelt Conservation Partnership (TRCP) on energy to engage sportsmen and others in an important policy issue affecting wildlife. TRCP also has developed a program titled Banking on the Backcountry to inspire policy around protecting backcountry habitats for wildlife.

Innovative Partner Activities for Conservation

Partnerships among the NGO community and wildlife agencies not only inspire new ideas but provoke novel activities that lead to conservation of species and habitat. These are conservation activities that might not take place or become institutionalized without partnerships. For example, one tremendously important innovation for habitat protection emerged from the idea that landowners can convey certain rights on their land while retaining other rights for themselves, which led to the development of conservation easements. TNC pioneered the concept of conservation easements when they adopted the donation of the first easement in 1961. TNC also played a leading role in the policy arena leading to the adoption of U.S. laws to support the development of this conservation tool (U.S. Tax Reform Act 1976, Uniform Conservation Easement Act 1981). Today, untold millions of acres of critical wildlife habitat are saved through this common practice of securing habitat protection through conservation easements. Other examples of innovative conservation activities spearheaded by NGOs include:

- Innovative models of land and water stewardship
    - RMEF Habitat Stewardship Program—3,900 projects in 27 states
    - Natural Capital Project (TNC, WWF, Stanford)
        - Ecosystem Services (WWF and TNC)

      (See 103 projects in 37 countries reviewed in Tallis et al. 2009)
    - Carbon Sequestration (Ducks Unlimited [DU])
- Partnerships for species conservation (RMEF, SCI, WCS)
    - Protecting the "Path of the Pronghorn" in Wyoming (WCS, Green River Valley Land Trust, Conservation Fund)
    - Fisher reintroduction in Washington with Tribal partners (WCS)
    - Wood bison reintroduction in Alaska (SCI and WCS)
    - Eastern Elk Management (RMEF)
- Implementing priority conservation in SWAPs
    - Wildlife Action Opportunities Fund supported 64 SWAP projects in 45 states
- Research and Science (WCS, WWF, RMEF, etc….)
    - Integrating science into conservation (WMI, AFWA, SCB and TWS)
        - WMI Science Reviews
    - Species research (WCS--wolverine, antelope, pygmy rabbits)
- Large-scale conservation assessments
    - Terrestrial Ecoregions of North America--WWF (Ricketts et al. 1999)
    - North American Grassland Priority Conservation Areas (CEC and TNC 2005)
    - Oceans of Grass: A Conservation Assessment for the Northern Great Plains (WWF 2004)
    - Northeast Regional Conservation Needs Project (WMI, Northeast Association of Fish and Wildlife Agencies [NEAFWA] and others)
- User group assessments and social science
    - Hunter-use surveys (TRCP)
    - Socioeconomic transitions and livelihoods (WCS--see Kretser 2007)

Many conservation NGOs have a long history of contributing their capacity and innovative skills to conduct conservation activities that enable SFWAs to better manage species and habitats.

Overcoming Partnership Challenges

Partnerships between NGOs and wildlife agencies are not without challenges and, like any extended family, there are inevitable disagreements. Learning to reconcile competing views, values and philosophies is all part of the transforming nature of relationships. Although difficulties can arise, it is imperative that relationships concentrate on common ground and the larger conservation vision. Jacobson and Decker (2006) pointed out that by broadening partnerships, SFWAs did not eliminate all conflicts but expanded upon common ground with most conservation NGOs. This resulted in conflicts occurring more at the fringes and much less at the center of the conservation community. When conflicts arise, it is important not to confuse various conservation approaches and the conservation targets (Redford et al. 2003). Despite different approaches, there are typically strong areas of compatibility when we focus on targets and outcomes.

SFWAs and Conservation NGOs can often reconcile or accommodate conflict by working under a framework of testable management assumptions. By demonstrating effective conservation and making decisions and implementation strategies transparent to each partner, many difficulties can be avoided. We believe the recent move toward applying truly adaptive management approaches to conservation can create a favorable atmosphere for better partnerships and cooperation. Good decisions and measurable outcomes will stand the test, and challenging each other under that framework will make us all stronger.

A key to successful partnerships with conservation NGOs is providing truly participatory governance (Fraser et al. 2009). While this is not a new concept, it has been gradually evolving, and new and novel approaches to make government more inclusive are emerging. Some SFWAs have embraced more deliberative approaches to becoming more inclusive and transparent in decision making. As with most institutional reforms, the shift from an authoritative to a more transactional model (Decker and Chase 1997, Chase et al. 2004) of decision making has been slow and has not been embraced at all levels. NGOs have emerged as social actors who can help SFWAs and local communities build experience with democratic processes in order to protect what remains of the wild (Fraser et al. 2009).

Occasionally, conflict becomes intractable and can inhibit good conservation and the transformation of organizations. There are several tools for coping with intractable conflicts that may need to be employed before partners

can move forward with an effective relationship. How the perspectives and views are framed and reframed during conversations and discussions is critical (Elliot et al 2003). Until the partners can begin to understand principles and values of diverse public interests affected by conservation action, there can be little progress.

Conclusions

Partnerships are essential to the conservation community in order to maintain legitimacy and relevancy in a changing world. Jacobson and Decker (2006) point out that according to institutional theory, if institutions via their key organizational actors are not able to connect to broad societal norms and values, it is likely that their legitimacy will be questioned by society, and their long-term viability will be uncertain. This is particularly true for organizations whose focus is management of public resources (Scott 2001). Partnerships between conservation NGOs and SFWAs will enable each organization to become legitimate agents of change … rather than victims of change.

Cooperation from other members of the conservation community will allow SFWAs to optimize biological and social diversity in conservation at a time when social participation in decision making is crucial. ‘‘Wildlife management is not an agency exercising authority over, steadfastly retaining control of, or even taking sole responsibility for wildlife resources, but instead wildlife management is wisely managing the sharing of responsibility for wildlife conservation with stakeholders” (Decker et al. 2005: 234). Sharing that responsibility through partnerships with conservation NGOs will make SFWAs stronger without alienating traditional constituencies.

Broad partnerships will be the mainstay of conservation programs in the near and distant future. There are many benefits to strong partnerships between conservation NGOs and SFWAs. These include helping each other create a collective vision for conservation, identifying common conservation goals and targets, increasing political and technical capacity, expanding the boundaries of each partner organization and cooperating on conservation activities. Although challenges are certain, we believe the benefits of partnerships for conservation will far outweigh the significance of challenges and enable the conservation community to meet the unprecedented changes we are facing.

The whole conservation community must remain focused on the conservation targets of species and habitats and minimize conflict over differences in approach, philosophies and perspectives in order to sustain “The Long View” for conservation . The world is changing equally fast for conservation NGOs and SFWAs as we share a common journey toward the same future. We are in a tight race to save the last remaining wildlife habitats and to promote the conservation of species against the demands of a growing human population. We will lose the race to conserve nature unless we can establish systematic collaboration between conservation organizations and governmental agencies (Redford et al. 2003). It is only through collaboration that we are likely to build a world based on the coexistence of humans and nature.

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Toward the State Fish and Wildlife Management Institution of the Future: Key Elements

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The state fish and wildlife management institution (Institution) (Jacobson et al. 2010) has evolved since its initial emergence (1863: Massachusetts Conservation Department). Some state fish and wildlife agencies (SFWAs) (e.g., Missouri), the centerpieces of the Institution, have undergone significant transformation while change in others has ranged from minor to fairly major expansion of programs. The traditional user pay/user benefit funding model for most SFWAs has not changed significantly in 70 years. SFWA trends during the latter part of the 20th century have been toward less autonomy, greater influence by governors and their appointees in decision making, greater control by legislators over budgets and spending, and subsumption into larger multidisciplinary "superagencies" (Wildlife Management Institute 1987, 1997). This combination of static funding and decreased authority of SFWAs has been coupled with Institutional trends toward greater demands for services, more interest in participatory decision making, a broader suite of stakeholders and a plethora of new challenges (e.g., biodiversity losses, diminished interest in nature, reduction in traditional stakeholders, climate change) (Jacobson et al. 2010). The overarching purpose of the Institution has remained much the same: sustain and perpetuate wildlife resources for the benefit of present and future generations of Americans. Some of these trends require the Institution to adapt so it may continue contributing to this purpose; other trends require more fundamental transformation. Undoubtedly, the most daunting challenge for the Institution is a desired pre-condition that would facilitate and pave the way for achievement of key elements: the recognition at the highest levels of government and society that wildlife conservation is essential not just for heritage and environmental values, but for the social, economic and physical well-being of all Americans. Essentially, this represents acknowledgement that wildlife conservation contributes significantly to the provision of ecosystem services whose collective value cannot be adequately priced. As a corollary to this, for wildlife conservation to deliver ecosystem services at a scale warranting elevation of stature within society, it must be broad based in scope and pursued with interdisciplinary vigor. We must assume that this ideal pre-condition will not materialize through some Lemuelian awakening in society. In reality, we may never achieve this ideal, but if we do, it will most likely result from concerted proactive efforts of the Institution that compel such recognition. Herein we outline seven key elements, based on work by Jacobson et al. (2010), we feel will be necessary for the Institution to remain relevant.

Legal Foundation

The Institution's bedrock is in the states' constitutional or statutory language that articulates its *raison d'etre*. States' legal codes should clearly establish that wildlife is held in trust for the benefit of current and future generations of states' citizens. It should define the trustees, those policy makers responsible for oversight of the management of trust resources and their responsibilities and accountability to the beneficiaries. The legal language should explicitly declare the SFWA as the trustees' agent, and the chief executive responsible to and appointed by the trustees. The language should include a clear definition of wildlife that is inclusive of all wild animals, including fish and invertebrates. The code should also provide for the perpetuation of natural uses (Sax 1970) particular to fish and wildlife, such as hunting, fishing, trapping and viewing. This legal code is the states' interpretation of Public Trust Doctrine for their context. The challenge inherent in transformation of states' legal codes is the uncertainty of the political process. The sausage you intend to make may not be the

[1] The views expressed in this paper are the authors and do not necessarily represent those of the U.S. Fish and Wildlife Service or the State of New York.

sausage that comes out of the grinder. Effective stakeholder engagement and coalition building will be essential for achieving desired legal changes.

Governance

The Institution should be governed by an apolitical but representative body (trustees) that is legally accountable to the public for upholding the legal doctrine, and is not controlled by a governor, legislature or particular interest groups (Jacobson et al. 2010). Membership is not based on affiliation or geography; it is based on citizenship and knowledge in areas such as finance, ecology and sociology. Appointments are made by a bipartisan legislative committee for multi-year terms. Such a model was advocated in the 1930 American Game Policy (Leopold 1930). Professionally educated biologists, natural resource sociologists and economists, and managers should provide the scientific and technical expertise necessary for the governance of the representative body. It must be recognized that frequent turnover of upper management and leadership positions may be harmful to the long-term durability of conservation measures, especially if leadership changes are politically motivated or engineered. Transformation to true trustee-based governance will pose enormous challenges. Within states that have political appointees as heads of their SFWAs, there will be resistance within the administration and legislature, because in effect, their control over fish and wildlife policy will be diminished.

Within states that have boards or commissions, resistance is likely as well because the key interests those bodies represent will resist any reduction in the influence they have on policy through their respective commission members.

Agency Funding

The funding mechanism for the SFWA should be broad based and equitable, rather than user based. User fees for special privileges such as hunting, fishing and trapping would still be collected and used to support and sustain traditional programs. The source of the broad-based funding could vary and be similar to some of the existing approaches found in Arkansas, Minnesota, Missouri and Virginia, where the funding is broad based, or use another form of assessment. The key is that all citizens share equitably. A mechanism for adjusting the assessment to keep pace with financial demands on SFWAs should be established and could be similar to the Wyoming Rural School model (Rural School Funding News 2008). This model provides for the trustees to annually evaluate economic indices and actual costs and make adjustments to the proportion of funds directed toward the school system. This process of adjustment should be transparent to all beneficiaries. Many states have been frustrated in their attempts to secure broader funding. Political resistance to imposition of any new assessments is fierce. Mobilization of a citizen advocacy base is hampered when the Institution does not include a broad citizen base and the SFWA is perceived to serve a relatively narrow suite of interests. Transforming our thinking about who represents the stakeholder base for SFWAs is essential if we are to broaden our funding.

Agency Organization and Structure

No particular organizational structure is prescribed; rather, the focus is on transformation of SFWAs' overarching goals. In other words, a change in organizational culture is more important that what boxes are in an organizational chart. The structure will evolve as a natural product of the direction agencies are headed in. The key features of any SFWA structure should be its avoidance of forcing a dichotomy between consumptive and nonconsumptive programs, and the professional nature of its employees. While challenges, information needs, program foci and expertise will vary across taxa, habitats, threats and uses, programs should not be segregated into divisional silos; rather, integration should be the focus at the highest levels. The organizational culture of a modern SFWA should facilitate rapid adaptation to changing environmental and social circumstances, characterized by behaviors that welcome innovative thinking and acting. Transformation of organizational culture within a SFWA is not a simple proposition. There is no cookbook. It requires stability in leadership and consistent, focused inreach as well as outreach. All employees must be engaged in the process

and have the opportunity to contribute to the direction the agency is heading in. Agency directors who are politically appointed have relatively short tenures (D. MacLaughlin, Association of Fish and Wildlife Agencies, personal communication). Frequent turnovers in leadership make transformation less durable.

Scope

The scope of the Institution and the SFWA's responsibilities should be broad and inclusive, representing the mandate to conserve all wildlife, habitats and ecological processes to sustain wildlife for the benefit of all people. A narrow focus will put the Institution at risk of becoming irrelevant in a changing society. Most SFWAs have broad legal mandates regarding species and responsibilities (Musgrave and Stein 1993), but in many cases this is not reflected in the scope of their programs. The challenge is obvious: limited funding from traditional dedicated sources makes broadening the scope difficult, and in some cases, unjustifiable. What may be required initially is an organic process of agency mission and goal transformation, a process that engages employees, the conservation community and potential partners.

Impact Management

A core aspect of the Institution would be a focus on impact management (Riley et al. 2002, Organ et al. 2006). Impact management positions the SFWA to focus on fundamental objectives determined in part by stakeholders. This is accomplished through the application and integration of biological and social sciences coupled with a rigorous stakeholder engagement process. The SFWA, as agent of the trustees, facilitates informed stakeholder engagement and defines for the stakeholders the limits as prescribed by law. The SFWA's responsibility is to foster an informed stakeholder base. The challenge for many fish and wildlife managers in adopting this approach is that this is not how they were trained. Most traditional training in fish and wildlife management has been in the expert authority model (Gill 1996) where the agency experts determine the objectives. True integration of biological and social science is difficult when SFWAs lack social science expertise and a philosophy that trusts stakeholders to engage with agencies in management decision making. Impact management will require transformation toward participatory decision making (Chase et al. 2001).

Accountability

The trustees are ultimately responsible for making decisions that fulfill the intent of trust law and serve the interests of the beneficiaries. Transparency in the decision-making process is essential. Facilitated stakeholder engagement and information sharing set the stage for deliberative decision making about priorities, where to direct resources and how wildlife will be managed. Inevitably, some interests will not be satisfied, but the trustees are accountable to the whole, not particular interests unless they are provided for by law. Legal provisions should dictate procedures for how challenges to the trustees' stewardship are dealt with. Accountability applies to SFWA professionals as well, who are directly accountable to the trustees.

Uses and Users—Traditional and Emerging

The legacy of wildlife conservation in North America is a direct result of the advocacy and passion of those with a vested self-interest in the perpetuation of wildlife: hunters, anglers and trappers. An Institution that conserves all wildlife for the benefit of all citizens must recognize that a minority of its citizens have been the driving force in its establishment and evolution into the 21st century. The success of the Institution may well rest on a core dedicated citizenry. The Institution should not cater exclusively to sportsmen and women, but it should provide for the sustainability of the natural uses that motivate them. These uses foster a commitment to the perpetuation of wildlife, and the availability to all marks our society as one of free citizens (Sax 1970). The Institution must also seek ways to encourage and support new types of dedicated "users," such as those with an inclination to engage in habitat restoration, citizen science and other volunteer efforts that serve as outdoor recreation activities. This can be facilitated by the broadening of partnerships that will engage other elements of society; elements SFWAs have traditionally found difficult to engage.

The Future

A modern SFWA should be an engine for comprehensive conservation initiatives that benefit all citizens, and that is supported by a stakeholder base that holds others in mutual respect for a common purpose: long-term perpetuation of fish and wildlife resources, and the freedom to enjoy nature. A critical role of SFWAs within the Institution will be to facilitate stakeholder engagement in a manner that directs focus on this common purpose. By building broad-based fish and wildlife conservation programs and initiatives, we will reach more of society. In so doing, we must link in the public's mind the ecosystem services these programs provide to their quality of life. Vested self-interest of hunters and anglers transformed destruction of fish and wildlife into a remarkable restoration effort. This was spurred in large part by the 1930 American Game Policy, in which Leopold called for "reorganization of game departments" (Leopold 1930: 306). We need to awaken the vested self-interest of all Americans toward the realization that protected open spaces and well-managed natural systems contribute to the well-being of their families and future generations. Realization of this will take more than reorganization–it demands transformation. Fulfillment of this will do much to ensure the relevancy of SFWAs long into the future.

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Town Hall Meeting:
The Impacts of Climate Change Legislation on Natural Resources Conservation

Cosponsored by the National Wildlife Federation and the Bipartisan Policy Center

Moderator: Doug Inkley, National Wildlife Federation

Good afternoon and welcome to this workshop, "The Impacts of Climate Change Legislation on Natural Resources Conservation." This is the third year in a row that the National Wildlife Federation, the Bipartisan Policy Center and the Wildlife Management Institute have collaborated to sponsor a workshop on climate change. The prior two were very successful, thanks to your participation.

I want to first acknowledge my colleague, and really the driving force behind these workshops, because he's done all the work on them, Mr. John Cooper.

The question you might ask is, why are we here today? Climate change presents the single greatest threat ever to fish and wildlife numbers and diversity. In fact, just a few moments ago in this room, the report, *Beyond Season's End*, was released. It deals with how to address the climate change impacts overall but also especially to the sport fish and game wildlife. As we struggle to come to terms with the climate change issue and how to address its causes and its impacts, we find ourselves often thrust into emotional debates—it happens all the time—related to public policy, legislation, funding and economic impacts. The recent controversy over the science of climate change is an example. The issue actually amounts to nothing more than a pimple on an otherwise huge body of science. Yet the issue has been so blown out of proportion that the belief and the reality of climate change have declined among the general public. So this workshop is designed to have an open discussion of the major national policies and legislative actions regarding climate change, and how they will impact natural resources climate change. No doubt you will be hearing different opinions this afternoon. We will have four or five speakers. We will then have a break, after which we will entertain an open hall town meeting format, chaired by Patty Riexinger, director of the New York wildlife agency. We hope that you all will be here for that, because she will be prompting you to ask questions of the panel and make comments of your own. It is with a sad feeling that I know all of you share, that I acknowledge that one of our speakers was scheduled to be Sam Hamilton, Director of the U.S. Fish and Wildlife Service. I know that we all mourn Sam's untimely death. He was truly a conservation leader, especially with regard to climate change.

Dan Ashe, Deputy Director for Policy, U.S. Fish and Wildlife Service, Department of the Interior

Good afternoon. It is with a bit of a heavy heart that I stand up in front of you today. As Doug said, we've suffered quite a loss, not just within the Fish and Wildlife Service, but within the conservation community as a whole. And it's an honor to speak with you today, although I wish it was Sam Hamilton delivering these remarks.

What I'd like to do first is address the backdrop of legislation dealing with climate change and particularly the potential for natural resource adaptation provisions to be included in that bill. I'm going to get to the adaptation strategy in a minute. First, however, last night [3/21/10] we saw the House of Representatives pass comprehensive health care legislation. And regardless of what you think about that from a kind of substantive or philosophical perspective, it was a substantial, historic event. Major legislation like that doesn't come along very often. In this case, you can go back to the Nixon and Roosevelt administrations when the country began talking about universal health care. What we have seen in the past just few years is really a rapid escalation of public awareness and concern. Also occurring has been the attention of the policy-making process toward climate change and controlling carbon dioxide and greenhouse gas emissions into the atmosphere, and the coming together toward a consensus to do something about those significant matters. There has emerged a very strong voice that natural resource adaptation should be a part of legislation dealing with climate change and the regulation of those emissions. These legislative processes often take a very long time.

Before I joined the Fish and Wildlife Service, I worked on Capitol Hill in what was the old Committee on Merchant Marine and Fisheries in the House of Representatives. We worked on the Endangered Species Act and the Oil Pollution Act and legislation establishing the National Fish and Wildlife Foundation, and the North American Wetlands Conservation Act. None of those things happened overnight. Most took a decade or more to get from a conceptual framework to kind of final passage and signature of legislation. So, when we think about this issue of natural resource adaptation, we really are only a few years into policy discussion, but we're very far advanced in terms of the opportunity that exists for substantial progress in the days ahead. As we think about this and what we'll hear from other speakers about what's happening on Capitol Hill, we need to bear in mind that considering natural resource adaption in the context of climate change legislation has come very far, very fast. It is a tribute, I think, to the work that has been done within our

community—including nongovernment organizations, states, federal agencies and private organizations working together to build and advance a message.

What I'd like to talk to you about today is some efforts that I think and we in the Fish and Wildlife Service believe are integral to moving this process even farther, and improving the prospects of legislative success for a fish and wildlife climate adaptation strategy that would provide a blueprint for common action. We know, and *Beyond Season's End* further chronicles there is urgent need for us to deal with the effects of climate change upon natural resources because those effects will be extreme. And we need to work together. We cannot deal with changing climate simply and exclusively within our individual organizations, from within the footprint of a national wildlife refuge or a state management area or a national forest or national park or a state or tribal reservation or a Department of Defense facility. We have to see changing climate and its effects crossing political and ecological boundaries. What we need is a way to think across the major conservation interests and identify the principles and methods that are going to be necessary for us to pursue as we try to ensure that we can sustain fish and wildlife and plant resources and the ecological processes on which they depend. In short, we need a blueprint for common action, just as we have done in the past with the North American Waterfowl Management Plan, the Migratory Bird Treaty Act, and other large-scale conservation initiatives.

The 2010 Appropriations Act provided us with an impetus to do this. The Department of the Interior appropriation bill directed the Council on Environmental Quality and the Department of the Interior to develop a national government-wide strategy to address climate impacts on flora and fauna and their associated ecological processes. This direction comes at an opportune time for us to think about a national adaptation strategy. It comes at an appropriate time when we are building capacity that will be available to support this type of endeavor. In 2010, Congress provided the Fish and Wildlife Service with $20 million to begin building a network of landscape conservation cooperatives that will provide shared capacity between federal, state, tribal and nongovernment organizations. It will allow us to see climate change and other large-scale ecological disturbances, such as habitat fragmentation, water scarcity and invasive species, and put them into a larger context, but in a spacially explicit context that will allow us to target work at the site scale. That, coupled with the availability of downscale physical climate information and regional-scale ecological response modeling, will come from a new network of climate science centers of which the U.S. Geological Survey is heading the developing. It has, I believe, $15 million in 2010 to begin building that network, so this broad-scale regional network of climate science centers, working with similar capacity within NOAA and NASA and universities, will be able to deliver downscale physical climate information, feed that into landscape conservation cooperatives where we can develop habitat and population response models and build predictive capacity that will allow assembly of a strategy for dealing with climate change at continental scale. This approach was called for in the Fish and Wildlife Service's draft climate change strategic plan, where we again look at the intimidating prospect of trying to deal with changing climate as well as a host of other disturbances and stressors that need to be dealt with day to day. Our climate change strategy identifies that we have to build capacity in order to support this direction. It has to be a partnership-driven strategy. A sensible strategy will build on existing partnerships, whether joint ventures, fish habitat partnerships or the Western Governors' Association's work on wildlife corridors and decision support systems, for example. In short, there are many efforts currently underway on which we can build.

Building from its climate change strategic plan, the Fish and Wildlife Service, in June 2009, held a conservation leadership forum at National Conservation Training Center, at which a relatively small group of 40 partner organizations were invited to come together and talk about this prospect of a national fish and wildlife adaptation strategy. In general, that leadership forum was followed with another forum this past spring at National Conservation Training Center. It involved more partners, so a total of about 60 organizations participated in the discussions. More than 90 percent of the people at the forums indicated that they either generally supported or strongly supported the idea of moving forward with a national fish and wildlife climate adaptation strategy.

At the most recent forum, in 2010, we came up with a vision, purpose and guiding principles statement and interim guidance for climate adaptation strategies. We are going to hold an initial listening session at this North American Conference, on Wednesday of this week, to speak specifically about the idea of an adaptation strategy. The next step will be a discussion of listening sessions across the country and beginning to build a national strategy on the interim guidance.

At last year's workshop, we spoke about using the recent guidance that was developed and published by the Association of Fish and Wildlife Agencies, which forms a guidance for the states in revising their state wildlife action plans. It could serve as a foundation for building a broader framework of principles and practices that natural resource organizations could apply. We then move toward an initial draft of the strategy in 2011, and complete the national strategy in 2012. The vision we developed is pretty simple but optimistic, I think. Ecological systems will continue to sustain healthy, diverse, well distributed and abundant populations of fish and wildlife, thriving in a world impacted by accelerating global climate change. The purpose is to build a strategy that will provide a unified approach and reflect shared principles and science-based practices. The goal is to reduce the impacts of climate change on fish, wildlife, plants and associated ecological processes across geographic scales. We identified some guiding principles for this effort, a

national framework for cooperative climate response and, in particular, we talked about the issue of a federal versus a national strategy. Clearly, we are looking for a national strategy--one that involves the federal government, states, tribes, nongovernment organizations and others.

The focus within our national boundaries in developing this strategy (but recognize that the problem is international) is a philosophy of collaboration and interdependence: we're all in this together. We cannot succeed without relying on one another. Using a landscape-scale approach and science as a basis, integration of adaptation and mitigation efforts is critical. We can't think about adaptation and mitigation separately. We also need a pragmatic approach with respect to ecological disruption, recognizing that we are going to lose biological diversity in the face of a changing climate. So, we need to begin to set clearer priorities and take a pragmatic approach.

We hope to have an interim guidance document that will be produced in 2010. It will be formed based on discussions such as this forum today and the Wednesday listening session, as well as broader listening sessions throughout the year that address both short- and long-term planning efforts modeled after the AFWA document. How can you get involved? We have a website that is going to allow a broad array of interest and interested parties to participate and comment as the process goes forward. I invite you to attend the listening session on Wednesday, and then help sponsor a listening session in your portion of the country. It is important that we think about a national adaptation strategy as we advance in the legislative process.

One of the most consistently asked and difficult questions we face with people on Capitol Hill about climate change legislation is what are we going to do that's different from what we are doing now? Also asked is, if we give you all these billions of dollars that you're asking for, can you show us what you will to do with them and how it will make a difference in terms of the response of fish, wildlife and the habitats that they depend on? So, the idea of a national fish and wildlife adaptation strategy puts our community in a key position to converse with and begin to influence Congress on climate change issues. Maybe the fact that legislation is not moving as quickly as some would like is an advantage, because it may give us the opportunity that, when Congress begins to take up climate legislation in earnest, we can have this interim framework document or perhaps a draft or developed strategy in place. In that fashion, we can begin then to articulate in a much better, much more direct way what we can do if given the opportunity and the resources to perform. Thank you very much for your interest.

Rick Krause, Senior Director, Congressional Relations, American Farm Bureau Federation

Thank you Doug, and good afternoon everybody. I really appreciate the invitation to talk here today, and I want to share with you some of our concerns with the current legislation pending in Congress, and also to talk about some opportunities where we can collaborate with moving forward on some of the wildlife and natural resource issues that face us with regards to climate change.

Before I get started, I want to give you a couple facts. In the course of providing fuel or food and fiber for the nation and the world, according to Environmental Protection Agency (EPA), agriculture and forestry emit about 6 percent of the total United States greenhouse gas emissions. According to the U.S. Department of Agriculture, agriculture and forestry currently sequester about 11 percent of total emissions—6 percent emissions versus 11 percent sequestration. EPA also says in its inventory document that agriculture and forestry have the potential to sequester about 15 to 25 percent of total U.S. greenhouse gas emissions. So, in terms of policy, we think it is much better to try to maximize the 15 to 25 percent through incentives and try to encourage people to sequester carbon and reduce greenhouse gas emissions than it is to try to chip away at the 6 percent emissions that they currently emit through regulation. Also, wildlife depends on open space for habitat. A lot of that open space is agricultural lands. A recent Government Accounting Office (GAO) report, and this is probably about 10 years old now (and I don't think it's been updated yet), found that about 70 percent of all species listed under the Endangered Species Act relied to some extent on private lands for their habitat. That same report found that 34 percent rely exclusively on private lands for their habitat. And most of those lands are agricultural lands. So, we see that there are some positive contributions to greenhouse gas reductions already being made by agriculture and forestry.

We also see the positive contributions for providing habitat for wildlife that private landowners can and do make. A viable agricultural sector is key to achieving policy objectives, whether it be through greenhouse gas reductions or through wildlife habitat provision. Cooperation with producers is absolutely essential if we are going to achieve those goals.

With that backdrop, I will talk briefly about where we stand on cap and trade legislation. I'm talking specifically about the major bills that are in Congress--the Waxman-Markey bill that passed the House last June and the Kerry-Boxer bill that currently is pending in the Senate. The Farm Bureau opposed both of those bills, and there are a number of reasons why. First of all, from our standpoint, it doesn't make any economic sense for agriculture. Any cap and trade legislation, or any cap legislation is going to increase fuel, fertilizer and energy costs. That's because any cap on any

sector, whether it be utilities, transportation or manufacturing, will increase costs that are going to be passed on down to customers and their consumers. Farmers and ranchers can't pass costs on to consumers, so they are stuck with the increased costs that are going to result from cap and trade legislation.

We also are very concerned about the availability and price of fertilizer if cap and trade moves forward. Natural gas is the primary component in the production of nitrogen fertilizers that our farmers and ranchers rely on to grow their crops. If natural gas is any way restricted or if natural gas becomes the switch for fossil fuels, as many contend, the price of natural gas for fertilizer production will go up astronomically. Also, there may not be enough natural gas available for fertilizer production, and the rest of the fertilizer industry will go overseas. Right now, farmers import about 55 percent of their fertilizer, and it all might go overseas if natural gas prices rise as a result of cap and trade.

There have been a number of economic studies with regards to cap and trade and its impact on different sectors of the economy. All of those studies only differ in the amount of the increases predicted. None of these studies, even the USDA study, indicate that there will be a net increase to people. Higher carbon prices might mean higher offset prices. However, the problem then is that there might be higher revenues through offsets, but there also will be higher cost increases for fuel, fertilizer and energy as a result. There will be a loss of international markets. If American farmers and ranchers in the United States incur higher fuel, fertilizer and energy costs and the rest of the world doesn't, the U.S. farmers and ranchers are going to be placed at a competitive disadvantage. And this will hurt our trade overseas. There are some provisions in the bill that would take care of manufacturing trade-intensive industries, but agriculture is not listed as one of those industries.

Agriculture is not provided for in the bill and the only reason is because agriculture is not subject to any of the caps. If a cap and trade bill is going to be passed, a robust offset system has to be a part of that scheme. That is a must. But offsets are only going to help partially. First of all, our economic analysis has shown that offsets are only going to defray partially any of the cost increases to farmers for fuel, fertilizer and energy. They're not going to defray the extra costs totally. Second, not all sectors are going to be able to participate in an offset program. For example, fruit and vegetable growers, cotton growers, federal livestock grazers and ranchers who graze livestock on federal lands are not able to provide offsets or participate in an offset process. However, they still are going to incur the same fuel, fertilizer and energy costs as the rest of agriculture.

As a general farm organization, the American Farm Bureau represents the interests of all of our members. Finally, what we have found in studying the offsets title is if the costs of carbon are high enough, people will be encouraged to plant trees instead of crops and to convert cropland to forest land. From our members' perspective, we are all in favor of maximizing revenues for our members, so we're not going to tell our members not to take advantage of an offset system that encourages planting trees. Absentee landlords are more likely to take advantage of this type of provision than others. In the Midwest, there is a large percentage of farmers who rent their lands from absentee landlords. It is going to be a lot easier for absentee landlords to deal with getting offsets and a check every year or twice a year than it will be for them to deal with tenant farmers and all the issues that brings.

The way these bills are administered right now, we are concerned that there will be less food production in the United States. Cropland going out of production could result in higher food prices here and abroad, and if we take land out of production, food production goes elsewhere--it goes overseas. And with American farmers being the most efficient food producers in the world, that would have the adverse effect of actually increasing emissions worldwide.

We also see very little or no environmental benefits as a result of any of this legislation. As you all know, greenhouse gasses are distributed evenly across the globe. A ton of greenhouse gasses emitted in Wisconsin is the same as a ton of greenhouse gasses emitted in China. You can regulate that ton of greenhouse gasses in Wisconsin, but, if you don't control those greenhouse gasses emitted in China, you are not gaining anything environmentally. Studies have shown that, if the Waxman-Marckey bill were enacted and worked perfectly as intended, it probably would have less than two-tenths of a degree difference by 2100. Lisa Jackson, the administrator of the EPA, said at a congressional hearing, "U.S. action alone will not impact CO^2 levels. This is a global problem and it requires a global solution." If China and India don't go along and enter international agreements along the same lines that we're looking at, whatever we do here is going to have very little or no impact.

Despite our concerns and objections, we are looking at resolving some issues. Farmers and ranchers generally are not opposed to wildlife on their property, although that doesn't apply to wolves, which eat inventory. A couple years ago, we participated in a very wide-ranging, broad-based coalition to enact the Endangered Species Recovery Act, which provides tax deductions for people who are making recovery actions on their own property. This was a very good, effective coalition with Farm Bureau, National Wildlife Federation, Defenders of Wildlife, forest and paper industry, Audubon Society and others. It really achieved some pretty remarkable results. We also participate in the Western Governors' Association Wildlife Corridors Initiative. Holly is going to talk a little bit about that later. So, we do understand and appreciate the issues, and we try to promote wildlife on our property when we can. It has to be through incentives rather than regulation. Programs have to be voluntary. Some of the programs that we actively participate in

through the USDA, are the Environmental Quality Incentives Program (EQUIP) and the Wildlife Habitat Incentives Program (WHIP). USDA recently announced a program to augment WHIP and EQUIP for sage grouse in the western United States, and signups are ongoing as we speak. Our members are very interested in participating in that program.

Adaptation is a process, not an event. I mention this because a financial advisor friend of mine always tells me that financial planning is a process and not an event. What that means is you can't simply declare a strategy or establish a program and say you're done with it. They, like adaptation, are on-going processes that evolve over time. A lot of flexibility is needed in any kind of adaption program.

Let me reiterate that active management is preferred as opposed to set-asides. We saw that with the Endangered Species Recovery Act. It is especially true with regard to climate change adaptation measures where things are dynamic. It's not strictly adaptive management that is needed, but active adaptive management for climate change measures. There are a lot of unique impacts on species and habitat as a result of climate change. Those are some of the reasons that I say that adaptation has to be a process and not an event.

Other than aquatic animals perhaps, for which impacts can be more precisely gauged than is possible for terrestrial animals, answers do not always come from models. Modeling can be worthwhile, but there are a lot of questions that still arise for which there aren't any answers unless one observes and reacts. For example, the big question is how are species going to respond and adapt? We don't know. Polor bears, for example, were grizzly bears at one time. They adapted. We see that spotted owls adapt to their surroundings. They're no longer strictly in old growth timber, but they have gone into newer timber as well. They adapted. We don't necessarily know whatother species are going to do. We have to be ready to react to where they are. Sometimes, their optimum habitat is not their only habitat. From a landowner's perspective, we have to be able to adapt to those situations based on how wildlife actually adapt. Often, this can be accomplished best not by using models, but relying instead on observations from those who are on the land and see adaptation on a day-to-day basis. Sometimes, they provide the best evidence of where things are going. So, species do adapt to their surroundings and you can't always model it. And how will habitat respond and react? We don't know that either. We don't know what habitat species are going to use.

If a program of land set-aside, easement or acquisition for wildlife or potential habitat for wildlife is accomplished in the name of climate change modeling and wildlife doesn't use that land as predicted, what happens to that land? What do you do with it? We are cautioned to be very flexible in how to respond to any of this. Species and habitat are in transition. Right now, the very nature of climate change is transition. We don't know where it's going to wind up. This morning, the gentleman from Wisconsin said that change will be anywhere from 4 degrees to 9 degrees in Wisconsin. We don't know what that means. We don't know where it's going, but we do know that it's going somewhere and it is in the process of going. So we can't be developing strategies now based on where we think things are going if we don't know where things are going. What I'm saying is land acquisition or easements may not be the best example or may not be the thing that works. But I do think farmers, ranchers and others can work together to try to address these issues in a constructive manner. Farmers and ranchers are receptive to doing these things so long as they're done in a constructive and meaningful way that has minimal invasion to their operations.

I want to leave you with the following. Farmers and ranchers in the United States and around the world need to know that they can be part of the solution. Thank you very much, and I look forward to your questions at the end.

Question/Comment: Rick, you quoted Lisa Jackson as saying that U.S. action won't affect carbon dioxide, and went on to say that, you know, unless China does something and India does something, and we all work together, nothing is really going to change. Is that also the belief? And I have no idea what the context was that Jackson made the statement. But is that also the position of the Farm Bureau?

Krause -- Response: We think that, in the absence of meaningful action by China and India, there's going to be two things that happen. First, we don't think there will be environmental benefits. We don't think there will be much impact on greenhouse gas in the atmosphere. And second, it's going to place American farmers and ranchers at a competitive disadvantage if they're required to absorb increased production costs and the Chinese and Indians are not. So, we believe that an international agreement is essential moving forward.

Question/Comment: But somebody has to lead the pack.

Krause -- Response: Somebody has to lead the pack, you're right. Except, leadership is not jumping into the pool, and then asking others to follow. Leadership is saying, if you jump with it, we'll jump with you. So, we're prepared to do this. If you go along with it, we'll do it. Putting ourselves into the pool alone, without any kind of guarantees from anybody else, we just think that that's not good policy. And based on the results of Copenhagen, we just don't see the will from

China and India and some of the other developing nations that need to be there. When the time is ready, when China and India and Brazil are ready to commit to some meaningful reductions, then we will certainly look at that as well.

Question/Comment: Following that up, what countries provide the United States with the most competition for agriculture and ranch products?

Krause -- Response: That's a good question. I guess it depends. China is getting to be a competitor. Brazil and Argentina are very big competitors. New Zealand and Australia are for beef, Brazil for soybeans and wheat. There are a number of countries that need to be addressing greenhouse gas issues, but aren't, and they are our big competitors. And I put Brazil, China and India in that category.

Question/Comment: A big issue right now for many of us who deal with wetland and wet meadow issues and try to work with private landowners who have wetland resources and associated uplands on their lands, there has been a variety of ways to try to do that. Over the years, there's been acquisition and easements. I know this is putting you on the spot, but what would it take in terms of the ability for wetlands to store carbon? You don't have to do very much with hydrophytic plants in order to get the benefit out of wetlands and their ability to store carbon. But would it take something like a change in the tax base for that piece of property that's in wetlands? Or would it be something where we're trying to come up with a program that matches rental rates if one were able to drain and make that wetland into cropland? What would it take to save wetlands and promote a better way of working with private landowners?

Krause – Response: One of the beauties of what we're talking about here is that incentives can take many different forms. We found that out with the Endangered Species Recovery Act, where we started out looking at tax credits for recovery actions, and it became tax deductions. Tax deductions might be a way to achieve that. Tax credits is another. You can go through formal programs such as the Wetland Reserve and others that are traditionally underfunded. There are a number of programs that can be done. And there are a lot of people who like to have those values on their property, and will accomplish that themselves. Some of the issues are the costs. If they were able to recoup some of the costs to do those wildlife practices and promote that kind of activity, that would be all that it would take. I think we need, as we tried to do in the Endangered Species Recovery Act, to try to get a broad array of things, aboard menu for people to choose from so that it would work for their particular situation.

John Kostyack, Executive Director, Wildlife Conservation and Global Warming, National Wildlife Federation

When Doug and Coop invited me to speak, I think their hope was that I was going to refute everything that Rick said, just to keep this interesting. But I'm not. In fact, Rick went out of his way to point out that our victory, our mutual victory on the Endangered Species Recovery Act. And to me, that's a great starting point for this conversation because that was a provision that was passed as part of the most recent Farm Bill, just a couple of years ago. And yet we started working on that in the early 1990s. In fact, we were all part of a keystone process, thinking about incentives for private landowners. And so the idea germinated, but what it ultimately brought to the finish line was that we had that strange bedfellows thing going. And that's the only thing these days that works in Washington, D.C., is if you can walk into an office with unusual partnerships, which shows that your particular issue brings people together as opposed to being devisive.

Now, you don't think that that's a good starting point for climate change, do you? In fact, I have been working on this issue for a while and, despite some of the heated rhetoric that has come out in the past year, it would be a very interesting graph to put up there. I don't have it for you, but next talk, I'm going to do it. The number of organizations from across the economic sectors that are saying it would be positive to put a cap on carbon pollution, and to put a price on carbon, not only for society but for their business. That is why I am absolutely 100 percent positive we are going to have climate change legislation. Notice, I didn't say this year. It's coming folks. And the point of my talk is to make it clear to you that it is coming, to talk to you about the basic outlines of the deal that is emerging and to give you a little bit of a sense of optimism. But I'm going to give you the punchline right now so you can start preparing yourself. You're going to need to get to work, because we want to get this thing done this year. We have no time to waste, and you're going to have an assignment when we leave here today.

I have to start with the science, even though all of you probably know more about the science than I do, because it serves as the foundation for everything we do on this legislation. Also, it gives you a little of the perspective into those of us who helped to craft the natural resources piece of the pending climate legislation. As you can see, the first thing one needs to do when talking about global warming is to note that the poles have been warming roughly four times greater than temperate zones. We are witnessing a collapse of the polar ice-based ecosystem. The challenge of conservation in

that system is essentially a process of disassembly and reassembly, and it is not an easy puzzle to put back together. Of course, the polar bear is just a symbol for what's happened to the entire system. We have a lot more warming piped into the system and coming our way here in the temperate zones.

In the temperate zones, we are starting to see these large events such as the mountain pine beetle infestation, and the loss of several species of pines across the Rockies and British Columbia and in the Pacific Northwest. The story here is different, and gives a sense of temporal scale and the challenge of blending different time frames. In the Arctic, the changes are very evident, whereas in the lodgepole system, nobody is arguing that the lodgepole pine system is gone or that we now need to start preparing to replace it. The word heard most places around the country when talking about adaptation is *resilience*. We want to make the lodgepole pine system more resilient as opposed to starting the process of replacing it. Here we have a whole different conservation challenge.

Ultimately, this all comes down to water. The hydrological systems are being impacted first and hardest. So we start by looking at what's happening to mountain snowpack, and a model of what's going on with snowpack in California. If you have been hearing about the fights over endangered species in the San Francisco Bay/Delta system with salmon and smelt versus the large agribusiness, including almond and pomegranate farmers, you know we've got a lot more of that to come. We also have too much water, best exemplified by the intensification of tropical storms coming off the Gulf, as well as sea level rise. Modeling of what's happening to the Blackwater Wildlife Refuge in Maryland reveals losses of major habitat types because of hydrologic change. So if we start at the ecosystem level, we also have to think about changes and adaptations at the species level, so we plan for management. We need to make sure agencies are equipped to deal with the large-scale hydrological challenges as well as species-specific challenges.

One of the most common problems we have with species, of course, is that their climate envelope is shifting on them. Studies done on the checker spot butterfly indicated its disappearance from the southern part of its range. Unfortunately, what happens in discussing this and similar issues is the notion instilled in policy makers that ecological communities will somehow shift northward and upslope or toward the poles. The stories of what's going on with the Arctic fox and the red fox at Baffin Island are classic examples of the fact that there will be some species that are the new natives--what used to be called invasive species—and they will compete with endemic species and pose major wildlife management challenges.

Of course, the whole frame of moving and shifting wildlife doesn't work for so many species across the planet. The best example is coral and its specific habitat needs. We are not going to be able to plan for the movement of coral across the globe in response to climate change.

So, how do you like that quick 30,000- or 60,000-foot elevation flight through major ecological impacts of climate change to wildlife? I bring that up as prelude to discussing how this issue has been dealt with at the policy level. First of all, there is no separation of the mitigation and adaptation solutions. They have to come together as a package, so all the major climate bills introduced in the past six or so years have had both mitigation and adaptation provisions. The mitigation provisions have almost universally been the so-called "cap and trade" approach, which is, you put a cap on the overall amount of carbon pollution that certain designated industries can release into the atmosphere. That cap declines every single year, and you sell permits or you give away permits, but either way, they are tradable pieces of paper. Therefore, there is a price on those carbon permits, and that price gets higher and more costly to do business using the old form of energy. As a result, clean energy becomes relatively more affordable. That's the whole concept behind cap and trade. If you discard the notion of a cap, forget about ever achieving the kind of rapid shift to clean energy solutions needed to get ourselves out of this climate crisis. Also essential to the architecture of these bills is the tradeability of carbon permits. They represent value that can be put to appropriate societal and environmentally responsible purposes. Under cap and trade, it's a pollute and pay system. Polluters pay for these permits, for the damage they cause, and including to ecosystems. And so we have been out there marketing this concept of ecosystem-oriented adaptation or natural resource adaptation, paying for the costs of pollution with payments from polluters.

As Rick alluded to, we have had two major bills this past year. In June, we had passage of the Waxman-Markey bill. Both bills use a 2005 baseline, and the House bill managed to achieve a 17 percent reduction by 2020. And using that allowance value I was alluding to earlier, it essentially would generate about $1.7 billion average annually for natural resource adaptation. It also had provisions for dealing with other forms of adaptation, essentially helping other societal assets survive climate change. The third way the bill would generate money for conservation is by means of carbon storage and sequestration, providing dollars for so-called offsets, to which the House bill made explicit reference. As Rick noted, offsets would pay farmers and foresters to have projects that increase the amount of carbon stored on their property. In addition, there would be what is known as supplemental incentives, essentially paying people to keep carbon in the ground.

On the Senate side, the targets were more ambitious—20-percent reduction by 2020. The dollar amounts generated would be somewhat lower, averaging $1.4 billion annually. But, the money actually is more secure in the

Senate bill that passed out of the Environment and Public Works Committee. This bill is often referred to as the Kerry-Boxer bill. It also had money for so-called general adaptation, as well as for forest and soil carbon.

To understand the climate legislation, you have to understand that we are one of the many thousands of voices participating in this debate. And one of the reasons for so many voices is the debate over who is going to be regulated by the cap. But there's a whole other part of the equation that doesn't get much coverage in the press, and that is how to spend the trillions of dollars that would be generated by the sale of these permits. There are a number of different estimates of how much value can be generated, but it is in the multi-trillions of dollars over the course of a 40-year program. We created a graph to try to simplify how the money was divided up in the Kerry-Boxer bill. The bottom half or so, 53 percent, essentially was designed to be given back to consumers to blunt the impact of rising energy costs that would accompany a cap. A small amount is for a combination of domestic natural resources provisions, as well as expenditures abroad for reducing forest degradation and for storing carbon on tropical forests. A fair amount of money, 13 percent, would be allocated to reduce our carbon footprint by improving technology. A fair amount of money also is for deficit reduction. And there's a whole bunch of money for so-called transition assistance. That is the one that gets really controversial with the environmental community. It essentially gives money to polluters to help them transition to a low-carbon economy. So, we are participating in a big scramble for a portion of this new money. As you're probably aware, there's very little new money that shows up any more these days in Washington, D.C.

I want to focus almost all the rest of my comments on the natural resources adaption piece of the two pending climate bills, and the reasons why are two-fold. First of all, many of you are familiar with all the various, existing federal and state programs for conserving wildlife. As one who has studied both federal and state wildlife law, I can't think of too many laws that are this clear and precise about helping wildlife and ecosystems survive and, in particular, survive climate change and ocean acidification. This is essentially a biodiversity conservation bill, and perhaps one of the most significant ones ever, if we manage to get it passed. And it has to be spent strategically. The other key provision I would highlight is none of this money flows unless action is pursuant to either a federal or state natural resource adaptation plan. Included are a lot of details about how those plans are to be put together in terms of process and insuring they have measurable goals and objectives.

Another key thing to know about these two bills is that there is a real effort to ensure the money will be distributed broadly across federal, state and tribal natural resource agencies. The idea here is that the agencies all have a different role to play. Each of them has leadership roles and dealings with different types of ecosystems and different constituencies. The Interior Department, for example, has about four different roles assigned to it under this bill. One with respect to its wildlife programs, another with its cooperative grant programs, the Land and Water Conservation Fund. Five different federal agencies participate, and state natural resource agencies get a very significant piece, as do state coastal agencies and tribal natural resource agencies. We have been making progress, despite the general negative tone of every climate change report out of Washington, D.C. However, moving from the process of getting a House bill passed to the Senate bill passed, has increased understanding of the importance of the bill's provisions. I would be positively thrilled with the language in the Senate bill if it was passed tomorrow. One thing that is absolutely clear in that bill, which is not in the House bill, is that every single dollar that gets devoted to natural resource conservation is outside the appropriations process. And I'm going to guess that most of you in this room, or a significant percentage of you, have participated in campaigns over the years, such as the CARA campaign of the 1990s, to get real funds for conservation, as opposed to money that depends on the whim of annual appropriations. This is a big deal. It also is a very strong definition of natural resource adaption to make sure the money is not diverted for non-conservation purposes.

The House bill was very vague about what other adaptation besides helping species and ecosystems survive would be paid for. The Senate bill actually is pretty precise about this, and has created several programs designed to build resiliency--all get money to the states. Both the House and the Senate bills have a notion of the extent of practicable avoidance of environmental degradation. But the Senate version creates very specific provisions for helping different forms of public infrastructure to survive climate change. One deals with water utilities, water quantity, quality and reliability; another deals with flood programs; and another deals with the coastal infrastructure. What I think is really significant about each of these programs is, even though they primarily address protection of human property and infrastructure, every single one of the provisions acknowledges that natural systems play a very important role in doing that. So, when we add up how well we are doing for conservation in this bill, we look to these provisions as well, recognizing that we're going to have to be sitting down at the table with utilities and others and structuring how this money is to be effectively spent. But, some very strong cases can be made to protect your drinking water supply by filtering groundwater through forests and such. This has potential real benefits for conservation, even though the title does not make that clear. I want to reiterate that, in addition to the adaptation money on the mitigation side of the equation, there are potentially some very significant dollars in both the House and Senate bills to help private landowners store carbon, both in trees as well as in soils. Most of the details on the House and Senate bills were kind of left vague, perhaps

intentionally. So it is difficult to calculate the exact dollar amounts, but some have suggested that this could be worth $200 billion a year for private landowners in the United States annually.

So where are we heading? If you were just to read the newspapers, you'd probably be folding your tent and moving on to another campaign. We are not quitting. This campaign is nowhere near done, and we are not leaving until it is. What I want to highlight to you is that there has been a behind-the-scenes negotiation going on almost since the Senate Environment Committee finished its work in November.

The three senators who have been involved are Graham from South Carolina, Kerry from Massachusetts and Lieberman from Connecticut. I want to emphasize the involvement of Senator Graham, a Republican, at a time where virtually all legislation these days has been stridently partisan. He has come to the table and has made it clear that crucial to the deal as far as he is concerned is putting a price on carbon, capping carbon and rapidly increasing targets, lowering the targets every year, and increasing the price on carbon to help transition to a clean energy economy. Senator Graham puts it in national security terms and in terms of the future health of our economy. That makes me very hopeful. I don't think the Senator would spend the amount of time he has the past four months in a room negotiating this bill unless he thought there was serious prospect for passage. The three senators have been doing a lot of outreach to other Republicans. There are lots of rumors about other Republicans getting ready to join. Things are going to be popping in the next week or so. They promise to release a draft or at least an outline of their work within the next week. I would say there is a strong possibility that gridlock will finally break. But, will I predict that it's going to happen this Congress? I don't dare. But I will say it's going to happen, and we need to be ready when it does. We need to make sure that we are well represented, well known and well heard by the time that legislation is finalized. As of right now, no announcements have been made about whether or not there's any dime or billions in this bill for conservation. It is going to be up to us in this room to make that difference. If the leaders of the conservation community don't stand up now and make their voices heard, then perhaps we don't really deserve it. Because there's plenty of other people who care enough, who are up there right now making their voices heard.

I am going to conclude by asking for two basic things. One is to make sure that both your senators know that you believe your natural heritage is indeed threatened by climate change. And two, that you pay attention to the climate legislation moving in Congress and help ensure that natural resources and protecting wildlife and ecosystems are a fundamental piece of it. This is our time. Thank you.

Question/Comment: As these bills sit now, is the anticipation that, if in fact one of them passed, then the monies that would be received by the states, would that be subject to the usual match of federal monies? Let's say that I am director in New Hampshire, and right now they could give me $10 million and say it's all mine if I had a 2 percent match, but without the match the monies would stay in Washington. Is that the way this might work?

Kaystack – Response: I've got good news and bad news for you. Let me start with the bad news—there is a match. The good news is, it's lower than any you've seen before. Right now, it says 10 percent. So I think there's an expectation states will come out with money but it's also recognition, especially if we have large-scale dollars, that the states would be nowhere near ready to produce the match. And obviously we want this to get going right away, so I don't think we could argue for less at this point. I think it was hard enough to get that in there.

Holly B. Michael, Oregon Representative on the Western Governor's Wildlife Council

Good afternoon, it's great to be here today. I'm going to be talking primarily about what the Western Governors' Association has been doing to address climate change and adaptation. It's a very exciting opportunity. Back in 2007, the western governors developed an amazing initiative, the Western Wildlife Corridors Initiative. And it's really in place to address crucial habitats in corridors, or connectivity for wildlife, across the western states, across state boundaries, across national boundaries, because we need to be looking at connectivity for wildlife to be able to respond to a whole number of stressors or conservation issues including things such as land-use change, transportation, renewable energy development, oil and gas transmission and, of course, climate change. What I'm going to do today is walk through three initiatives or three components of climate change the western states are dealing with, and then discuss a decision support system that we are developing.

The first thing I want to talk about is the Policy Resolution 092 that the governors adopted, which supports the integration of climate change science in the West. It is essential to recognize that the western governors feel that this is something that the West can take on and has a responsibility to take on, for their respective states. In planning for adaptation--and we're not trying to reinvent the wheel--we really are trying to do this in cooperation with many federal and other state agencies, NGOs, and others that have expertise we don't have. We are looking for funding for research, as everyone is, and you've heard that over and over again, and you just heard in John's talk how important funding is going

to be. And it encourages the development of the National Climate Service, sort of a collaboration of the federal agencies in cooperation with partners, but bringing together not just the natural resources components of this, which we've all been talking about, but it brings in all the other things that we recognize but haven't addressed, such as social, health and economic trends. We're doing this in Oregon right now. We are developing our own state climate change strategy and, in the process, trying to bring natural resource issues to the table with social, economic issues and values. It is hard to find that balance when resources are very limited.

Policy Resolution 092 talks about determining uses for adaptation modeling. It seems like there are a dozen different ways we can do this modeling, but we're going to find one that looks specifically at natural resources and economic policy. And we are going to be developing a scoping report for the governors really highlighting what next steps are needed?

We recognize what is happening. We are aware of the other efforts out there. How do we find our niche? How do we make a positive contribution to this effort? To give you an idea of some of the membership and various councils associated with the Western Governors' Association, there are water councils, the governors' wildlife council, forest health advisory and the regional air partnerships. Policy Resolution 092 is just getting underway. Give us a little bit of time to get our feet on the ground, but we'll be back with more reports on that.

The other interesting policy effort is the resolution on regional national policies regarding climate change globally. It calls on the Obama Administration and Congress to act decisively to create a national policy. They are all things we have talked about already, but I'd like to emphasize encouraging job growth. As natural resource managers, we know the importance of economics to our local economies, the folks we work with every day in the agriculture and forestry industries. Urban businesses have got to be part of this solution and part of the partnerships. The resolution calls for the federal support to include climate scenarios in water plans. Not just how are we going to manage, conserve and supply water in the future, but issues such as drought and flooding. The western governors certainly support the use of greenhouse gas mitigation tools, but they have not specifically identified the one they would like to see used.

Incidentally, Madeleine West is here from the Western Governors' Association, and she's a real great contact for anyone.

The Western Climate Initiative is not exactly the same as the Western Governors' Association's initiative. Not every western state participates in this, but many do. But I want to give you a sense of what's going on with this other initiative in the West. Its goals are to promote clean energy and energy efficiency. The initiative complements but doesn't duplicate the work of the Western Governors' Association. It sets some very clear directives about regional emissions and joint registry to track, manage and credit these reductions. The initiative is going to tie into that interesting, new creature we're calling cap and trade. It designs a market-base mechanism and it is another thing just getting started. We'll be working on this Memorandum of Understanding. I'm sure it's just to give you a bit of a heads up about this exciting new opportunity. The folks involved in the development of the MOU, and it was signed by a number of governors and representatives of a number of Canadian provinces. There were other observers from the U.S., Mexican states and Canadian provinces. I want to emphasize again that this initiative is separate from the Western Governors' Association, but it's certainly a coordinated effort. We are hoping this Western Climate Initiative will be a framework, a template, a foundation for a national effort, and provide the sort of structure that will have been tested over time. And we know there are going to be some policy needs there.

Something very near and dear to my heart in particular is the initiative of the Western Governors' Association. I don't think there's anything else like it in the country. I think it's an amazing start, a vision, a recognition of the need to move conservation forward, to look at it in new ways and look at it across boundaries. Among the many things that the initiative instructs us to do is to support research, to understand climate impacts on wildlife habitat and corridors, and get into some of the things Dan was talking about. There'll be some spatially explicit mapping in here, which is very exciting, because for many people, it's seeing where on the landscape these crucial habitats and corridors are, and how it can help them do a better job of planning, and getting involved early in those conversations.

One of the first things that we're doing as a wildlife council, and every state has a representative on the council, is to develop a decision support system, similar to that used by the medical industry. It fits in very nicely, we think, with adaptive management and structured decision making. But these are not the answer. Decision support systems are a tool. They provide information and spatially explicit layers that can help make better informed decisions about where to focus research. Industry can overlay potential project development sites and see those areas that are going to be pinch points, areas of concern because they are crucial or important corridors. It will enable an assessment of the challenges to be faced in getting a development on the ground, and taking advantage of some of the best opportunities.

I want to emphasize that it's tough to get data to talk across boundaries and to have data talk to each other even within a particular state. It's a challenge we're working on, and I'll address how we're going to do that in a second. But, here are some of the things that a decision support system can do. It sounds like it's just another way to look at

information, but it is an important chance to promote the conservation issues of every fish and wildlife agency. It is initially going to be set up for state agencies, but it's going to be a tool for all entities to use.

It is very important—and this is going to be essential—that the public have access to this information and these mapping efforts. It is going to be important that we are transparent about our process and what we've got on these maps. A lot of folks are showing up at our council meetings, sometimes 75 to 200 people, and they're telling us they are excited about this opportunity to see this information. Identifying corridors—what's a corridor, what's connectivity—some people, it's a little, almost like a sidewalk—some people, it's a big landscape—we've got a lot of challenges ahead of us in trying to address how this is going to look on the landscape. One of the ways we will look to coordinate this is with a tie to the landscape conservation cooperatives that Dan Ashe discussed.

We have a lot of information to compile. And we're going to be using landscape-level mapping. It is important to emphasize that they are not regulatory. The maps are meant to be a tool to help with proactive and strategic investments in planning and implementation. Also, they are not a fine-scale tool. We don't anticipate them being used to develop the individual little project site. They are used to take a coarse, filtered look at the landscape. Here's a quick example. In Oregon, we held a workshop last week for our agency commission on habitats and decision support systems. We brought in some folks from Montana to talk about theirs, which is almost done. I understand Arizona's and Wyoming's are up and running. If you go on their fish and wildlife agency websites, you can see these tools. You will be able to look at a map of Montana, and pull up individual areas of it, and on the left-hand side are some of the different overlays of different types of species, habitats, utilities and Google maps as an underneath base layer. It helps inform, not just of response to climate change, but all resource, management and research opportunities and questions that need to be asked.

This exciting tool takes money and a lot more expertise than some of us have here. So we are starting off with some regional wildlife pilot projects. Many states, including mine, aren't adequately staffed right now to be able to develop this massive system. But, it's a wonderful idea to take across. There are multiple states involved in each of these smaller pilot pieces of a decision support system for a specific area that crosses state boundaries. They are building the kind of infrastructure needed, seeing what kind of data are available and what more is needed. We are going to test the waters here a bit before we launch into massive state agency program developments. And all of the pilots are being done in coordination with a lot of federal agencies, nongovernment organizations and industry. And, again, we're getting a lot of support from the U.S. Fish and Wildlife Service, especially for some workshops the agency is going to be doing on our behalf. The pilot projects cross multiple states. Alaska has its own--the North Slope Caribou Project. The California, Nevada, Utah and Arizona one is Mojave Desert. The Washington, Idaho, Oregon one is on arid lands. Idaho is doing another one with Montana on border corridors and connectivity. Wyoming's doing a project on coordination with federal agencies. Colorado and New Mexico are doing one on border corridors and connectivity. North Dakota, South Dakota and Nebraska are doing grassland habitats. And then Kansas, Oklahoma and Texas are doing lesser prairie chicken.

I want to emphasize here that not only are these going to be very good test models for us but to see how they integrate well with the Landscape Conservation Cooperators. While I was on an African safari recently, with a bunch of fish and wildlife biologists from the states, we hung out with a few fish and wildlife biologists in South Africa and primarily Batswana. And there was a lot of discussion about global climate change. The change and concern about it involves not just North America, believe me. The African biologists were very concerned over the impacts of climate change on their landscapes and particularly on their megafauna. When talking with them, I realized that they don't have even one-one hundredth of the resources that we have. They have a tremendous amount of dedication and some great people there, but not nearly enough even to begin. I came back here with a renewed commitment that this is the right time to do this. The need is urgent and we have the right tools and the right partnerships to be successful. Thank you.

Jim Martin, Conservation Director, Berkeley Conservation Institute

I want to start by thanking Senator Warner for begging out of this Conference and letting me squeeze in edgeways, because this is going to be fun. I want to start out by telling you about my favorite movie, *Indiana Jones and the Raiders of the Lost Ark.* I don't know if you remember this one, but here's Indy—he's down in the Mayan temple room. He's sneaking up the channels. There are darts whizzing by him, there are trap doors opening up. All Hell's breaking loose, and Indy is headed for the temple room, and he gets there. There are cobwebs and dust, and he can barely see; nobody's been here for a really long time. And there, sitting on the pedestal, is the idol—beautiful, Mayan, gold idol—it's sitting right there. Now Indy, he's pretty cagey. He knows there's a trap there, so he brought along his little bag of sand that happens to weigh just the exact amount as the idol, and he grabs that idol, and he's got that bag of sand, and he flips the idol over, and sets the bag of sand on there and backs up, and grins. He hears a little click and he backs up. What the hell was that? A wall opens up and this rock comes crashing into the idol room. The next thing you know, Indy is racing down this tunnel, with this big-ass rock right behind him, and I'm going "Run, Indy, Run!"

Folks, you heard the click a while ago. That rock is right behind us. But there's two of them. The first one is the habitat destruction and the habitat fragmentation that's associated with the population growth of this country, and the horrible, inexorable grinding development process that is chewing fish and wildlife habitat to powder. The second rock is the change in the climate. Both rocks are right behind us. And if we do not have a sense of urgency about rising to this occasion in this historic moment in our profession, I suggest we take another look at our core priorities, and work on what's most important right now.

I come from salmon country. I'm an Oregon guy. I'm a fish squeezer and proud of it. And there, we are wrestling with a 150-year challenge--can we, in fact, live in harmony with coho salmon. We're looking at a human population projection from year 2000 to year 2100 of at least three times, maybe four. Think about the change where you live in your lifetime so far. Think about the place you learned to hunt and fish. Think about the place you grew up. How has it changed? And then look at your children and anticipate what's coming. And if that's not a challenge enough to just scare the living hell out of you, then consider this. By year 2100, where I live in Portland, Oregon, we're going to have essentially the climate of Sacramento. For people who can't understand complex global climate models dissected down to your local area, just do this. Get in your car, drive 400 miles south; go to someplace that has three times as many people, and look around. You know, fish guys are kind of simplistic sometimes. Look around at your future, at the future that your children will experience in their lifetime. And then understand it's time for us to be more relevant than we've been in the past.

You know, there was a time when the North American Wildlife Conference, maybe when I started forty-one, forty-two years ago, was about counting the deer and setting the season. That's not the center of our work any more. Sportsmen's services are damn important, and I'm a died-in-the-wool deer hunter, and I love all that stuff, but that's not the center of our future. It's not the center of our challenge. The center of our challenge is to evolve into a new role, which is being the advisor, the trusted advisor, to the political system and to the people as they ask—what can we do about all this?

I worked all my life in the Oregon Department of Fish and Wildlife getting ready for when I went to work for Governor Kitzhaber. He turned to me, down in Salem, and said, "Well, what about these coho salmon, Jim, can we save them or not?" For that moment, all the sausage making that was going on down there paused for a moment while he was asking me what we can do. That is what we're evolving for. That is the center of our work. The most important decision that any professional will ever make or your agency, any agency, will ever make is what you're going to work on and what you're going to pass on. Sportsmen's services aren't the center of our future. Answering that question is the center of our future, and that's what we're talking about today.

For a long time, people have been arguing about climate change. I do not believe that the deniers of climate change are the central issue. It's the people who are depressed about it. We've gone rapidly from denial to depression. When I talk to my poor, long-suffering wife of 41 years, Carolyn, she says, "Jim, don't talk to me any more about climate change, you'll wear me out." Inevitability is our challenge--the challenge. The challenge is that we will suck the juice out of everybody, and they will just kind of give in and go, "Oh, shit." That's the enemy. Let's leave hope on the table.

I'm the son of a dairy farmer in southwest Michigan, and I'm here to tell you, dairy farmers and farmers in general are pragmatic people. They want to be problem-solvers too. The foresters and the farmers of this country can already see things changing across this landscape, and we need solutions that are contexted in a sensible framework policy with the right funding, the right incentives, the right disincentives to drive us toward trying a heck of a lot of solutions. I want to just say, my first message to you, is let's leave hope on the table. Giving into depression, as if this is some undeniably inevitable thing, and we're just going to lose all the poor birds and fish and wildlife. You know, it's a little premature for that. We've got a lot of strategies, and that's our job. And let's start out by talking about this with some positive energy, and leave hope on the table. We need a federal policy. I don't know if it's this bill. I'm hoping it's this bill, but improved. We need a federal policy, which is essential for a framework for how to move forward as a country, when a whole bunch of other countries on this globe are moving forward. And we need to try a lot of things, because I guarantee you, there are going to be a lot of surprises. And we need to be agile and adept to read those responses and jump quickly to strategies that will work better and to investments that will work better. We need a consistent strategy that deals with emissions, with adaptation, with monitoring and more funding. If we don't get the core funding to do this work, I guarantee you that every fish and wildlife agency in this country is headed for a humungous crisis within 25 years.

I personally believe the North American model of conservation funding is already broke. The foundation already is crumbling. We are already pricing ourselves out of hunting and fishing in this country. With the rapid expansion of expectations with endangered species, general habitat, general consulting, we can't get from here to there in funding that kind of work with sportsmen services fees. We can't do it. In 25 years, we will be lucky just to be able to use sportsmen services fees to do sportsmen services. If we don't make the jump to a fundamentally different funding paradigm in this country, we will be, in 25 years, stretched between the public expectation that we will do biodiversity work, habitat and

climate change adaptation, and the sportsmen who are still valiantly trying to pay the bill, and the system will break, and agencies will slip into irrelevancy. That's what we're facing unless we make this jump now.

I am so proud of The Wildlife Society and the American Fisheries Society for the work they are doing on this topic. I am so proud of AFWA for the work it's doing on this topic. When others are laying low and shutting up and backing away, these organizations are stepping forward and, in my opinion, meeting their moral and ethical responsibility to stand up and speak out. And I'm not talking about extreme sky-is-falling weird talk; I'm talking about the talk we have always done, earning respect on the ground with plain language about what we don't know and what we do know, what we've documented about the shifts in these ranges, what we can see the impact coming. Plain language starts at the local level and goes up through the states, and it tiers all the way up to national conversation about what we know about this, what kinds of actions make common sense now and what are the consequences of delay.

The analogy I use in this example is a great wave is rising way out there. You know, I'm from the Pacific Coast. Way out there, there's a great wave rising. There are some people who don't believe it's rising yet. Most people do, but they haven't seen it yet, they're not quite sure how big it is and they're not quite sure how damaging it will be. And some people will want to wait until they look up and go "Oh shit." And it will be too late then. This great wave rising is coming more at our children than at us. It's coming more at our grandchildren than even our children.

The time for action is now, and for plain language, sensible plain language that people can understand. When I talk about climate change, I don't talk about the IPCC report. I talk about fire insurance. How many of us think our house is going to burn down? Nobody thinks his house is going to burn down. How many of us have fire insurance? All of us. How come? Because even a low probability event that's a disaster, you insure yourself against. We need some fire insurance right now people, because this wave's coming.

I talk about medical advice. People understand about medical advice. Your kid gets sick, you take him to the doctor. You think the doctor has perfect knowledge? Hell no. Do you get a second opinion? Damn right. But you take the advice, even though there's a possibility there might be a mistake because you cannot afford to jeopardize the health of your child by ignoring even imperfect advice. We're talking about the health of our globe. We're talking about the health of these resources that we've spent all our life working on and we're going to hand off to this next generation.

We need to start out by just talking plain, sensible language to people. I teach at Oregon State University and I tell my students, how many of you want to make a difference? Oh, they all want to make a difference. How many of you understand that to make a difference you want to effect political decisions? Oh yeah, they understand that. How many of you want to work with the media? Oh, none want to work with them.

Well, here's the fact of the matter. The only way that this policy will get set is by moving the needle on public opinion. The only reason we are as close as we are right now is because scientists have been telling plain language, common sense stories about what they're seeing out there across the landscape. And people are listening, and people are interesting, and the needle on public opinion is moving. And the art of the political possible is shifting. I worked for Governor Kitzhaber, a fine, fine person, but he was a politician. He watched those polls like an eagle, because every one of these guys wants to get reelected, and the range of their courage is limited by the possibilities that are made possible by public opinion.

We have a moral and an ethical responsibility to stand up and speak out, as individuals, in our professional societies and in our agencies. And sometimes that's speaking out to our neighbors and our colleagues, and sometimes that's speaking out to our directors and our governors, and sometimes that's speaking in front of the mike to CNN and saying what we know. And we will be influenced by environmental groups to exaggerate and say the whole sky is falling. And we will be influenced by others who want us to sit down, shut up, count the deer, set the season, get back to business and get out of this political stuff. And they are equally wrong. We have a moral and ethical responsibility to tell it like we know it, and to not either understate or overstate our uncertainty. We need to not be afraid of controversy.

Teddy Roosevelt was not afraid of controversy. Teddy Roosevelt took on Standard Oil. Teddy Roosevelt set aside 91 million acres of forest when everybody thought he was a maniac. But he had the courage of his convictions. He could see into the future. He was not afraid of a fight, and neither should we be. Nor should we be looking for one.

What would Aldo Leopold do right now? Aldo Leopold would not be back in the shack shuffling papers and counting data. Aldo Leopold would be speaking out to the people about the relevance of the land ethic now, at the time when our profession is facing its greatest potential relevance.

We need to influence the public's understanding about this issue with plain language conversation, particularly to the media. Particularly to the media. Because the good news is, people of this country care about wildlife. The bad news is, they don't understand. They don't understand the relevance of this to their local area. They think this is all about Kyoto and Copenhagen, and Micronesia going under the water. They think this is all about these big headline stories. But all politics is local, and it starts out with us just talking about what this means for salmon, where I come from. Or pheasants and deer and migratory birds, the things that are grounded where you come from. We need to say that this is real. We need to show what we know and what we've measured and what we've counted to demonstrate it is real. We need to show that

it's accelerating, because it is, and it has huge implications. And there is still time to take action. There is still time to build up our state wildlife action plans, and to put a climate scrub on those, and to have some sensible investments ready to go when the money starts flowing. There is time now for a monitoring program that we can build off our current monitoring program, to be more robust. Because I guarantee you there will be many, many surprises, and the key will be to be agile, able to pick those surprises up and shift our strategy. And some of those investments are going to be wastes of money, and that's OK because we're going to learn from them. And some of those investments will be better because of them.

We need not be afraid to stand up and speak out at this time. We need to not be afraid of a little controversy. I believe the stories that are being told all over the world about wildlife now are literally moving the needle of public opinion every single day. And I believe the agencies involved in AFWA, and the professionals in this room and other leaders in this room have the choice of speaking out clearly or laying low. And there are some in our profession who are so sensitized to controversy they are wanting somebody else to do the heavy lifting, somebody else to be the point of the spear, somebody else to take the hits, and they're just hoping the money will flow and they can lay low and keep quiet and have it both ways. They can't.

We have a moral and an ethical responsibility right now to tell the truth and neither overstate nor understate it. I believe this is the time of the greatest relevance of our profession ever in its history. The great relevance of our profession emerged from the terrible disasters of wildlife that scared the hell out of Teddy Roosevelt. That was a seminal, formative time of our profession. We have a bigger challenge now. Because we're talking about something lots more than hunting the buffalo to extinction or watching the passenger pigeon go. We're talking about whole ecosystems starting to unravel, trying to move, and we've got the migration corridors blocked, because we've got this tremendous development juggernaut that's operating independently and synergistically with the climate change. People who are studying climate change largely aren't studying development patterning. And people who are studying development patterning aren't studying climate change. But if you look at it from a salmon's point of view, they hit like this and expand exponentially, and that's why we're going to have so many surprises. Now, the question is whether we deploy to pick them up and jump quickly in our strategy. I believe that, if the resource were in any more trouble, we wouldn't be able to save most of it. And if the resource were in any less trouble, a lot of people wouldn't care. This is the perfect time to do our work. And I believe this bill will pass. And I believe money will flow. And I believe we will be positioned with the leadership of AFWA and our professional societies to begin sensible, strategic investment, and begin the active learning process right now, right here. We can catch up with the rest of the world and we can lead. We can do that in our time right now. Now, there will be some people who will say I'm too busy counting the deer and setting the season, but for most of us, we understand we have to do sportsmen services and we have to honor and respect those sportsmen. We have a whole symposium tomorrow talking about the changes coming to fish and wildlife agencies, and I'm proud to be associated with that. But, today, I want to say simply this is the best work of our profession. This is the time to leave hope on the table. This is the time to have an agile, robust investment and monitoring strategy. Let's get busy. I'm excited to be here. Thanks for having me.

Panel Moderator: Patricia Riexinger, Director,
New York State Division of Fish, Wildlife and Marine Resources

My name is Pat Riexinger. I am the Director of Fish, Wildlife and Marine Resources in the State of New York, and I also happen to be chair of the Association of Fish and Wildlife Agencies Climate Change Committee, and had the privilege of participating with the team last year that helped produce the document "Incorporating Climate Change Into State Wildlife Action Plans and Other Natural Resources Plans." So the rest of the time we have here is scheduled to give folks an opportunity to ask questions of our panelists, and get out any questions you have regarding climate change. They don't have to be questions, they can be comments and statements as well. We've noticed that, if you just tack the words climate change up on a door somewhere, people come in. It's one of these themes that people are interested in, some because they're curious, others because they need to learn, others because they're a little bit nervous. Whatever the reason, I think we're really early on the learning curve, trying to figure out what's going on, where we're going, what we're doing. So, we want to give you this opportunity for the next hour and a half to have an open opportunity to speak up, to ask questions and be heard. There may be some new folks in the room from a little bit earlier, so I'm just going to quickly recap sort of the general theme of what our five speakers spoke about. Dan Ashe talked about the compelling need for a collaborative national approach to adaptation planning. Rick Krause shared the concerns of the agricultural community and the impacts of the cap and trade proposed legislation, yet he noted the willingness of farmers and ranchers and foresters to be partners in the climate change solutions. John Kostyack reviewed the urgency to take action, and he graciously recapped for us the federal legislation, in terms of the various options out there and the opportunities it presents regarding providing revenues, and a call to action for us to address climate change. Holly Michaels reviewed a very real

example of an initiative of the states and regional scale of collectively addressing a very salient natural resources issue. Then, she actually talked about some very specific pilots to try to bring that to fruition throughout the western states. Finally, Reverend Jim Martin got up and inspired us all with the real sense of urgency and a call for all of us to get up off our butts and get out there and make a difference. So, with that, I would open up the audience to any questions and I know you have them.

Question/Comment: We went to Rio, we went to Kyoto, we went to Copenhagen with a 40-year plan. And in each case, the 40-year plan pretty much got shot down. The world, they said, was not ready for a 40-year plan. I don't know if I was around for some of the early, large, major environmental legislative acts—Clean Air Act, Clean Water Act, ESA, all in the early '70s. What we did was we passed something that got us started. And then we had a schedule for reauthorization, and we moved down the tracks. I was actually in the Bush White House for the signing ceremony in 1990 for the Clean Air Act. We had an acid rain title, we got 10 million tons; the scientists had said 16 million was really what we needed. But we got, you know, 60 percent of that. We did a cap and trade scheme that reduced the costs of compliance far below even what the environmental community had estimated. When the Bush Administration's Office of Management and Budget in 2004 took a look at the cost effectiveness of clean air, they estimated we got back $8 for every $1 we invested--highly cost effective. But in all those cases, there was a need to get started. And so I guess my question is, are we ready to take half a loaf? The McKenzie Company, a blue chip business consulting firm, released a recent report that the first, maybe 25 percent of what we need to do is highly cost effective. It pays for itself. There's no doubt about it. And so, even if you're a climate change skeptic, it's an insurance policy, to pull off of what Jim was saying, that we're paid to take. So, are we in the community ready, if we can't get the whole enchilada, to take half of an enchilada to get started? Ten years from now or five years, whatever the time frame would be, we have more science for the doubters, we have more technologies for getting our costs, for meeting the need. I know some guys from Battelle and MIT who have figured out a way to use post-recycled municipal waste safely to create ethanol. This is something, you don't have to mine it, you don't have to drill it, you don't have to grow it. So, how do we think about this, so we really don't come out of the 111th Congress with empty hands as we did at the three international climate change meetings?

Panelist: I think it's an excellent question. One of the things that really confounds this whole process is what the scientists are telling us about what the targets ought to be. If you follow just the science--which some in our community say, "follow the science, you'll know exactly what to do"--we would never get a bill. Just think about what it would take to get us to a safe climate, which is ultimately the goal here, right? A safe and livable planet. A lot of scientists are telling us that's 350 PPMs of carbon dioxide in the atmosphere. That's going to take decades, even under the most aggressive scenarios. So basically, we're all going to be living in a very changed climate in the next few decades no matter what we do in the policy world. So, what is the goal for the first piece of legislation? I think the way you framed it is exactly right. It's the first one, and we're going to be fixing it frequently after it passes. I think the most important principle is that we need to have enough of a price on carbon that it truly transforms our economy, so people can understand it actually is in our self interest to use clean energy and not dirty energy. And that was the problem with how Kyoto largely played itself out in Europe--they didn't set the price high enough for carbon, so it didn't truly transform it, although they got a lot of benefits. It was still worth doing. I think that's the ultimate test. It's not going to be 350 PPMs, and it's not going to be all the dollars that the conservation community anticipates. It's not going to be a nuclear-free bill. It's not going to be an off-shore drilling-free bill, I'm going to predict. And still, if it sets a good price on carbon and truly drives that transformation to a clean economy, that's probably the ultimate test of the bill, in my opinion.

Panelist: Quickly, just one other example of where we did succeed, and we forget about the Montreal protocol. CFCs presented a real threat to the Earth, and the community of nations got together, and, you know, we don't hear about positive stuff by the press very much, but we're really about half way there already. We're eliminating CFCs. They're going to be completely eliminated, people estimate, by the end of this century. So we have kind of saved the world once. We should be able to do it again.

Question/Comment: For Jim, but others may want to comment too. You started your talk speaking of two boulders, either one could kill us. One is habitat destruction, one is climate change. And I have a concern about, basically, the distribution of effort and resources, to the potential loss of momentum on protecting habitat and open space. So I wondered if either you or perhaps Dan or John might talk about strategies, either contemplated now or perhaps in the future that might help us protect open space, reduce the rate that we lose habitat while adjusting changes associated with climate.

Panelist: I think the things that you would, in general, do for adaptation strategies at the more regional or local area are exactly some of the same things you'd want to do for habitat anyway. I'll occasionally run into these people who are complete doubters on climate change, and I'll say, OK well, tell me about what you see with development. Oh, development's chewing resources to pieces. Oh, OK, if development's chewing resources to pieces, then what would you do about it? "Well, I'd make sure I had riparian areas, so I'd start protecting my watersheds. I'd protect my source water. I'd make sure that I doubled up, so the riparian areas I'm going to protect also could be migration corridors. And I'd look for where they aren't adequate for migration corridors, and then I'd back them up with secondary migration corridors." We wouldn't get very far down the track before he's starting to describe the same things that you're going to want to do if you're a climate change believer. So, I don't see them at all as different things to do, I see them as reemphasizing the same things you do, because at the end of the day, what is it we decide in our conservation landscape strategy? We decide where we're going to develop, and we decide where we're not going to. And we want to have a landscape view projected across the landscape through time to make those decisions, instead of the typical fragmented development decisions, which are made all across this country largely by local government, that have almost no conservation horsepower built into them. Then along comes the state or federal government saying please, please don't do that, you're going to screw up the watershed. Well, you know, the fundamental issue here is we don't have the right incentives and disincentives and the right framework for local governments to operate within, and the right incentives for them to operate within a conservation framework rather than opposed to it. The way we're doing it right now, kind of the old traditional conservation concept, which is, you buy some wildlife rich area, you throw a chain link fence around it and you develop the rest, and you call it a refuge. That's bankrupt; we cannot do conservation that way. We have to do conservation at watershed and landscape scales. Now's our chance, and whether you're primarily motivated by climate or by development, or whether you're scared like hell of the intersection of the two, and the synergistic effect, which is what really bothers me the most, we're not going to overdo it for wildlife. The high probability is we're going to underdo it for wildlife. If we don't think more strategically, we're going to be in danger of somebody having the money and us not knowing how to invest it, and that would be a travesty. So, I have a sense of urgency. I think money's going to come out of a bill like this. Will we be ready at the bioregional scale to know what our first $100 million of good investments are?

Panelist: I'd add one additional point, and that is that the two are inseparable, in my view. We can't go about habitat conservation and species conservation the way that we have in the past because we know that the climate is changing. And so, if we simply say that we're over-focusing on climate change and we should be focusing more on traditional habitat and species conservation, and we do that the way we've always done it. It's like driving a car by looking in the rear view mirror. We're looking at the past and we're trying to figure out species and habitat conservation needs without really looking into the future. We know the climate system is changing and we know that's going to affect ecological relationships and the distribution and abundance and health of fish and wildlife populations. So we can't separate habitat conservation and species conservation from climate change. It's all one package. We have to be much more model based, and much more predictive as we go forward. So it's the right question to ask, but the two aren't separate. They're one and the same.

Panelist: I agree that it's really one cohesive approach. We need a holistic look at all of this, and a couple of things came to mind. One of the things that we can't afford to wait on in response to climate change, and it didn't get talked about a lot today, is that invasive species are expected to increase significantly and continue to move across the landscape. That is going to affect natural resources and some of our native species, but also agriculture and forest industries and others. We can't wait 5 or 10 more years to deal with this. It is one system and, as you heard from Rick here, wildlife use agricultural and forest lands. We had better be pretty darned concerned about what's happening with invasive species across the entire landscape.

Another example is fire. With the changes in climate, we're going to see an increase in fire in many parts of the West and pieces of Oregon. It is going to affect our sage habitats obviously and our forests. In talking about our state climate change plan, we are talking about public health and safety; we are talking about the risks to communities from fire, including the risk of respiratory diseases from smoke inhalation and things like that. We are looking at the cost to communities to fight fires and to our state department of forestry to be able to do that. Climate change isn't just about critters and habitat, and believe me, I'm not trying to diminish them in any way, but it's about looking at a cohesive, holistic system that feeds and supports both the economic and the natural resources component.

Panelist: Let me build on that. The fact is that agriculture and forestry provide a lot of the habitat for species already on private lands, and most species do live on private lands. Agriculture and forestry, as mentioned, are in that sink right now for greenhouse gasses. Agriculture and forestry emit about 6 percent. They sequester right now 11 percent of total emissions and have the potential to sequester 15 to 25 percent. A strong and viable agriculture will address both of those

issues, but there are a lot of attacks on agriculture from different angles. There is the animal issue, and some of the water issues. Some people want to take water away from agriculture for use somewhere else. Agriculture provides habitat and it reduces greenhouse gasses. A viable agriculture will help achieve both of those goals, so please consider that as things come up in your states and your communities.

Panelist: Many of the state wildlife action plans address climate change, and identify the habitats most at risk from a number of stressors. Those habitats were prioritized, and many states also identify spatially explicit areas on the landscape to make investments for corridors, for ecosystem integrity, etc. So there are some opportunities already identified to focus work.

Question/Comment: I agree completely with the comments that have been made from the panel. You can't unlink habitat and climate change. But if we're looking at how to move forward in the short term, with an expectation that we will get long-term gains out of it, I would suggest that we probably already have a blueprint. If you look at the growth of the National Wildlife Refuge System, the biggest growth and the greatest vision for that system came out of the 1930s and the Beck report when Ding Darling and Ira Gabrielson said they wanted to establish a system to provide secure habitat for recreationally viable populations of waterfowl for the future enjoyment of the American public. The basic principle involved there was capturing secure habitat on private and public lands across the full geographical, ecological and geophysical range of the species. By doing that, you are capturing different populations of the species and providing them with an opportunity to adapt and evolve to changing conditions. That's exactly the same challenge we are facing today with climate change. So, if we have a secure national habitat conservation system that captures the full expression of ecological systems, and if we examine it closely, we might also find that it actually captures the full range of many of the species we're interested in.

Panelist: Could that be complemented by state and NGO-held preserves as well? I wonder if we have really thought out strategically that network of refugia on the landscape, where we can protect all types of habitats and provide them in close enough proximity so that, as species need to adjust their ranges, they are within a migration distance that the species can actually achieve.

Question/Comment: Yes. Such activity is going to be a huge issue, so CRP lands, CREP, other systems in which we secure habitat, are really going to be important. State wildlife action plans gives us a link to the local level that I think could be carried back up to the national level.

Panelist: That would be a very expensive proposition. I think you could get a lot better bang for your buck if you were to consider enacting incentive programs for existing landowners—farmers, ranchers and others—to take active management for species that are on their lands or that might move onto their lands because of climate change. I see at least a couple of benefits of that over secure refuges. First, it's going to be less expensive. Second, you're going to get active management by people who are actually living and working on the lands rather than a refuge system that may or may not be actively managed. Third, farmers and ranchers and private landowners can adapt a lot quicker and a lot easier than you can from moving targets from climate change. As mentioned earlier, we really don't know what the effects of climate change are going to be on species. Really, we don't. We don't know whether species are going to be able to adapt to existing habitats. We don't know whether they're going to go follow the habitats that our models tell us they are going to go, and we don't know where they're going to end up. This is, right now, a transition period with most species and habitat. What if you were to buy a refuge, for example, and species decided to bypass it. Then where would you be? I think that you really need to be able to be adaptive. If you have active management through something like an incentive program for farmers and ranchers to provide habitat, you have a win-win situation. The species win because you're actually there and can adapt to their needs, and landowners win because it allows them to continue operating, and it's a voluntary program, so they're making the decisions.

Question/Comment: I don't think that what I said was inconsistent with that. You notice I said secure habitat on private and public lands. I did that for a reason. And I think incentives to landowners—and a much greater tool box of incentives for landowners—is absolutely critical.

Panelist: Then I guess I just wanted to clarify it, because when you talk about refuges, you're talking about state, federal or basically non-private land. But thanks. I'm glad that that's not what you intended.

Moderator: This is an interesting example of where we're having to see, perhaps, an evolution of our conservation tool box as well. You cited the National Wildlife Refuge System, which has been wonderfully successful since the 1930s. But what we're hearing is that maybe moving forward, i.e., driving out the windshield, as opposed to the rearview mirror, we may need to look at increasingly flexible conservation options. And maybe we need to start incorporating some of the Farm Bill incentive programs to identify interim or adaptable measures for providing some of these landscapes that we need. For those of you who were here this morning to hear about adaptive management, maybe we need to identify some places on the landscape where we have greater flexibility adjusting as we move forward. Maybe we need to start looking and some different types of incentive programs to fill in the gaps. We're not going to get rid of the refuges. We're still going to need to buy land, but maybe we also need to identify places where we can increase the network.

Panelist: I'm actually in complete agreement. I think we all understand the value of the National Wildlife Refuge System, and the value of the principles under which it was founded. But as we've shifted to watershed and landscape-level conservation, we obviously can't buy enough of it and own it by government to make it work. So, the challenge of the day really is to create a landscape, a conservation landscape, at various levels of protection across the map, anticipating shifts and changes in habitat and ranges, and making it work for a landowner. The problem is the incredible value of development on the edge of the city. How do you create a strong enough incentive basically to block the tremendous economic incentive to develop? And not just for landowners, but particularly for local governments. The people who are making these decisions largely are local governments, and they are desperate to provide services—teachers in the classroom, cops on the street, highways that work—without raising taxes. And how do you do that? You expand the tax base. How do you do that? By developing land that's low value into land that's high value, and you tax it at the general rate. So, the incentive to develop is tremendous, and that's something we've got to wrestle with.

The second thing I'm in complete agreement with is that the best conservation program in this country is CRP. And I think right now we are seeing CRP unravel before our eyes and, if we don't make some fundamental changes in the program in 10 years, CRP will be largely a shadow of its former self. We can't put enough money on the table, with the current federal budgets that we have right now, to compete with corn or wheat. Unless we have a layer of incentives associated with carbon, and a layer of incentives associated with watershed health is the only way we'll save CRP. So I see an interaction here between this climate bill, for example, and something that could make a practical difference to a riparian landowner in Iowa or Nebraska deciding to re-up for CRP or plant corn. But we've got to be able to sweeten the deal. I think we can't have traditional commodity-type conservation programs in the Farm Bill. We've got to have interaction that layer extra incentives to create the conservation landscape that we really want to anticipate.

I also agree that we can't tell for sure where all these species are going to be. So what we have to have is a conservation landscape that preserves ecological function and let the animals move. And some of those places we're trying to save salmon, we are not going to save them. They're going to be gone; and that's just an inevitability. But every kid doesn't necessarily deserve to grow up next to salmon, but they deserve to grow up in a good watershed. These will not be wasted investments if we protect ecological function, even if salmon are there or salmon are not there, because there'll be other species there. And we deserve to grow up in healthy watersheds.

Panelist: One thing I want to make sure we don't forget is the role of a number of organizations out there--Land Trust Alliance, for example. Regarding climate change and the role of land trusts, some of the other conservation groups, such as Ducks Unlimited, The Nature Conservancy, Trusts for Public Lands and others that are acquiring lands or at least getting them into some sort of a conservation status in the long term, are also providing a way to secure important landscape. So lots of partners out there—government won't have to do it all.

Question/Comment: I have two questions. I want to pull on this thread where we're talking about the importance of ecosystem function. There has been some really good articles in the literature the last couple of years stating that we may need to give up this focus on species and, in a more pragmatic sense, focus on ecosystem function. But we see evidence all around us that our society is ecologically illiterate. So what do you think the challenges are, and what are some potential ways of addressing ecological illiteracy as we move from focusing on charismatic species to ecosystem function?

Panelist: I would maybe go back to the conversation we had about habitat, too. I don't see a real effective distinction, because my sense, from a management organization standpoint, is that ecosystem function is an important ecological concept, but it's not a very good management discipline, because you have to be able to tell people what to do. What and how much ecological function do you want to protect, and where upon the landscape? In order to do that, you really have to then get back to the outcome that you are trying to drive. In our world, those outcomes are species and population outcomes. So, I think it's our responsibility to define the ecological processes that we need on the landscape—how much

do we need, where do we need it and when do we need it, spatially and temporally, across the landscape? We need to look at that from a species construct, and I think people get that. In *The Harvard Business Review* there's an advertisement for a business process. It shows a whole chain of process for energy savings that go through a couple of business processes and pieces of equipment to reduce the energy costs, to reduce CO^2 emissions in the atmosphere and, at that point in the advertisement, there is a polar bear. So, people do understand ecological process, but the way they understand it is by seeing the man at the station on the landscape, which oftentimes are mega fauna. In some regards, we have to stop fighting that and give the people what they want and what they'll understand. And when we talk to them about ecological process, they don't understand what we're talking about. When we talk to them about the relationship between atmospheric carbon dioxide and human-based emissions and sea ice and polar bears, they get that. They understand it. So, I think we actually have to stop feeling guilty about looking at ecological process through a species lens.

Moderator: I am one of those people who believes that people put animals on their ties for a reason, because that's what they're excited about. They're not excited about the wastewater treatment plant that makes clean water for the trout; they want a trout on their tie. So, I have to agree that that's what sells it, and we are the people who need to put the pieces together behind the scenes to lay the foundation for making sure the trout are there for their ties.

Panelist: I agree with both of those sentiments. We grew up with these species over the millennia; we evolved side by side with them; and we have a deep, innate connection with them. We should never lose that connect. It is our strong suit and we should not be afraid to wear it proudly.

I want to make an additional point because one of your other related questions was about ecological illiteracy and how much that hampers our work. I agree with that and think we all have a responsibility to look beyond just our work on science or policy in proving our relevance, and to consider how we're nurturing the next generation. We don't spend enough time on that. We have heard all the statistics about how this current generation of children are basically growing up indoors and have not had those formative outdoor experiences. And we will not have another generation of conservationists unless we take action right now to get people outside interacting.

Related to that, we have to think about more professional development. The whole green jobs mantra we hear in the context of climate change is always in the context of somebody building a wind turban or solar panel, and almost never in reference to work on habitat. And I believe we need to change that entire frame. Some of the most exciting jobs out there are working on habitat. That's my bias. We need to consider how we start to discuss our work when we talk to up and coming professionals. We are in the business of saving the planet--that's a pretty good motivator and a pretty attractive job description. We need to be working within the universities to redefine the curricula, to explain the relevance here, because the language you see in the curricula is outdated in many places. I don't believe that any effort is being made right now in the high schools and elementary schools to explain the relevance of this work.

Panelist: A couple things are important from the messaging standpoint. One thing that seems in all the polling and all the experiences we've experienced is that, if you talk to people about healthy habitat for people and wildlife, they want it tied to their family. They want to know that clean water and clean air will be there for their families and future generations. If it happens to benefit wildlife too, all the better. Tie it to an iconic or charismatic species, wonderful, but tie it to families. When you have healthy systems, it supports both. And let's face it, people respond to stories, not to science. They don't want to hear why it's important we do this; they want to understand the story behind it and how it is meaningful in their lives and how they can make contributions. As scientists, we often think it's much more important to get the data out there and tell them the science says it's right. The general public is going to respond much better, in some respects, to stories that represent the values they hold important.

A personal peeve of mine about some scientists I talk to is that they don't want to talk in plain English. They feel like it's dumbing it down, and I've heard that expression used. People who've heard me talk before will hear this again. Tim Russert, who ran "Meet the Press" every Sunday for many years would call his dad at home in Buffalo, New York, after every broadcast and ask him, so, how was it? His dad was a garbage man for many years, retired. And he was Tim's gauge, and he never felt he was dumbing down anything. He felt like he was talking to someone in the general public who had a general interest and knowledge level. We have to remember that we're not, for the most part, talking to scientists out there. Scientists start with a summary and then give background. People just want to know how it works and why it is important.

Panelist: I think people, in fact, do identify with healthy water, healthy communities and working landscapes. They don't know how to translate that into what it would mean for a conservation landscape. But at a time like this, when we're in the middle of the financial crash and state agencies are absolutely desperate for money, Minnesota just passed a huge bond issue. How could they do that? They didn't sell walleye fishing and they didn't sell white-tailed deer. They sold water.

That was the issue that has traction. Our job is to try to describe to people what healthy communities are going to look like when there's three times as many people in the state, whether the water supply will be secure or not when there are three times as many people. We have change coming. Our job is to be the translator. People in the future won't care so much about individual species. They're going to care about whether they have healthy communities and adequate water, but we can tie those ecological functions back if we do the right translation. And if we do the right translation, we'll get the political and financial traction to move toward a conservation landscape. If we don't, we'll end up with a few little postage stamp refuges and everything else will be developed. And we will have missed the boat on the challenge of our time.

Question/Comment: I am with the U.S. Fish and Wildlife Service, and I want to talk about bureaucracy. And I can't believe I am going to say this, but it's a wonderful topic and it's part of my job. You made the comment when you started that if you put climate on the door, everybody will come. That's true right now, whether you're a non-government organization, a federal agency, a state or tribe, everybody's on the climate bandwagon, and rightly so. It is probably the biggest challenge we will ever face in our history, and if we don't succeed in this, we'll be in serious trouble. So, it's obviously a big issue we need to face. However, right now, what is happening a lot, whether you're with an NGO, federal or state agency, everybody is trying to figure out how to step into the climate world and start their own planning process, figuring out how to go after the funding that's out there. And there is funding. So we're all going down that road. The Fish and Wildlife Service is no different, and the Department of the Interior is no different with the Landscape Conservation Cooperatives. So I'm bringing this up as a commentary, because we have a mix of people on the panel to get people talking and thinking about how we get out of our own way, how we work together on planning on these different initiatives so that we can support each other and work together. There are good actions underway right now. Landscape Conservation Cooperatives is a great idea. The states individually are doing great things. Some of the works of the NGOs are really good, as is the Climate Science Service that NOAA is drafting. There are some great things out there, but how do we get together on them, and how do we find a way to cross our governmental and NGO boundaries so that we're putting these actions together and being as effective as we can be?

Moderator: Are you feeling as overwhelmed as I feel at times about this?

Question/Comment: We all are. You know, it's a good thing we are working on this now, and trying to cross those boundaries and figure out how to do this. I figure this is a good time for us to talk about it, so we can try to figure out how to deal with those boundaries, how to keep moving forward and not get in our own and each other's way.

Panelist: I think you asked exactly the right question. My sense is that we're in a learning and coping stage with climate. We're all kind of coming to the realization that it is a big issue we have to deal with. We're trying to deal with traditional mechanisms of coordination, and they're not good enough, and they're not going to be good enough. We have to realize that we have to build shared capacities. Part of what we're trying to catalyze with Landscape Conservation Cooperatives is to say we shouldn't all be running off on our own paths and developing the same capacity in organizational stovepipes, and then trying to coordinate those capacities. We should be building capacity together to deal with this issue. That's the most important principle for me is that we should be building capacity together from the beginning, because we can't build it separately and sustain it, and we can't build it separately and build effective coordination mechanisms over the top of that. That's the most important thing. The other thing I talked about earlier today is that we need to be doing some basic architecture in the beginning. And if we do that, then the types of capacities that we need to build together and the things that we need to do on the landscape will hopefully sharpen in focus. If we look at 10-year windows, we are going to learn a lot. We probably should be looking at five-year windows, because we are going to be learning very rapidly as we go through time. But if we invest some time in making that architecture, and then evaluate that architecture on five-year bases, we will benefit in the long run.

Panelist: We need a combination of breadth strategy and depth strategy. The breadth strategy is everybody trying to do his own thing, which is okay because you have a lot of tries going on and as long as we're collectively learning from one another. The depth strategy should be to build off the national waterfowl plan and create some pilot joint ventures in each of the major ecoregions of the country. We take a big chunk of land, bring the key players who are familiar with that together and say, if we were just trying to create a conservation landscape in this pilot area right now, here's what it would look like. Here are the areas we would need to own as government to have the maximum conservation benefit. Here are the areas we ought to have in conservation easements. This is what it would look like if money were no object and we were trying to preserve as much ecological function and biodiversity as possible.

Now, project out 50 years of development. What's the population projection for this pilot joint venture area? And how will that affect the opportunity? Now, put a climate overlay on it—50 years of climate change. Now ask yourself, what key investments would still make sense in this area with that kind of population growth, that kind of development trajectory, and that kind of climate change? And learn how to create that layering in pilot areas so that people who are doing their breadth strategy, kind of bumping along as we go, will benefit from that. If we did that for 15 or 20 years, and did a good job in each regional ecoregion of a major joint venture pilot, we would learn collectively more.

Moderator: I would like to complicate your question or your statement by reflecting on the fact that, not only are we, as natural resources managers, bumping into each other on climate change, but there are other sectors out there that also are addressing climate change adaptation. And some of the things they are doing may be things that would advance some of our own needs. Buffers are one of my favorite examples. You can do an awful lot with riparian buffers in terms of protecting public safety, improving water quality and providing protection for aquatic habitat. Those could even become your migration corridors for species over time. But there also are things they are potentially proposing that could have adverse impacts on natural resources. If you look at shoreline hardening where you may be getting increasing storm events or sea level rise, there may be things being proposed in other sectors that would have adverse impacts on natural resources. Not only should we be trying to figure out what we need to do, but it behooves us to be active members of the broader dialog, even though we all would rather go out and live in the woods with squirrels and not talk to people. We really need to work with the other sectors in order to make sure that natural resource issues are accommodated and not violated.

Panelist: To complicate your question even further, don't forget the economic interest as well. We still need to have a very viable economy and need to be conscious of that. Anybody we bring in as partners or talk to--farmers, ranchers, others—ought to be those who are involved with the economy.

Panelist: I spent a lot of time thinking about this. One of my great fears, having made adaptation my full-time job, is that I will have spent 25 years working on adaptation and still never have seen it actually applied on the ground. We have so many great planning processes, and very thoughtful, very committed people who are doing adaptation planning, yet, those who are operating the policy world are desperate to have stories to talk about where adaptation is happening on the ground. Generally, we don't get a lot of answers and examples because everybody's still trying to figure it out. So we have to give ourselves some timelines and a little bit of structure imposed on this so people actually are obligated to try to figure out and then apply it.

My basic model is bottom up and top down. First of all, all adaptation is local. LCCs can be a good start, or maybe they need to be smaller, more ecoregional. But give people a deadline and let them experiment, and then we can all have a lot of shared learning from those experiments.

Here's the top down part. I think you need a little analogous version of "bracketology" here, since I hope everybody's into the NCAA tournament right now. The first bracket is where all the ecosystem habitat wildlife people get together, to duke it out and figure out what their conservation goals and strategies are. And then, those moving into the Sweet 16 can sit down with the agriculture people, the water infrastructure people, the reservoir building people, the levee building people, the sea wall building people, and duke it out Then we come out with some real outcomes on the ground, because it is going to be a collective vision that's going to be applied uniformly on the landscape.

I don't believe that right now is the time to have an integrated adaptation planning process. I would not like to take all the money for adaptation and throw it in one big pool, and say go out there and do adaptation. There are some very conflicting societal goals out there, all of which fall under the heading of adaptation. We can adapt for the purpose of saving that second vacation home on the coast, or we can adapt for the purpose of saving coastal wildlife. We probably can't have both at the same place at the same time. So, there is a lot of work to be done still within the conservation community to figure out what our goals are, what our objectives and timelines are in particular landscapes and ecoregions. Then there needs to be a whole additional adaptation process that shouldn't be done in a vacuum. We need to engage with the other economic sectors and the other public agencies that have their own adaptation goals. How many years did I just get us through just to get to that point? Then, of course, Congress expects some deliverables from all this, and not just a lot of talk. That's why it needs to be top down. Everybody believes in bottom up and experimentation, but if somebody doesn't pose some structure on that, we could truly be talking for 20 or 25 years before anybody actually does anything.

Panelist: I don't think we need to start from scratch. We already have a very effective program in joint ventures; we have state wildlife action plans; and we have other initiatives out there that we can use as a foundation and then expand to the kind of vision that I think the LCCs bring to the table. There has already been a lot of conversation about how we make all this fit together without being redundant. We need to look at all the layers and decide the niches that each entity can play

within the larger scheme. And it may mean that some will have to give up something. In my state, we are developing a decision support system for fish and wildlife. So is our Department of Forestry and our Department of Transportation and Health and Human Services. We don't need four decision support systems in our state. We're going to have to pony up and partner up and, probably give up a little bit in that process. I think it plays out at any level in there, and I want to make sure we emphasize that. There are roles we can all play. I've been approached by five different federal agencies that are all doing their own decision support systems and want us to participate and help with that. It's just an example. I'm not picking on the feds here. All the states are doing the same thing. There's got to be a way to streamline this, to find ways to have one overall vision at a national level or at a state or regional level, and have entities step up to the plate and say I'll fill that, and somebody else fills this one. I think that's going to be effective. And I think you'll see that some of these decision support pilots from the Western Governors' Association can maybe be a bit of a start on that.

Question/Comment: I just came from a two-day workshop at the Ecological Society, looking at the state of ecological education in the schools. They described the problem that they're trying to treat as nature deficit disorder. Rick mentioned in his original presentation, and then brought up again later here, the estimate that the agricultural sector broadly could (and these are my words) roughly double the sequestration potential by doing something. Is there any more specificity available there? What kinds of changes do you have in mind? And how would they, in turn, affect the habitats that are now provided by those entities?

Panelist: A lot of what they're talking about is planting trees. I think that if that replaces croplands then production is reduced and food prices possibly raised. That's something we're looking at. I don't think EPA really did give much more specificity, but there are things, such as tillage practices, that farmers can adapt. No till, for example, leaves cover on the soils when they plant. That sequesters carbon. And there are various other cover crops that they can use, and other things that can be done that will increase sequestration of carbon in the soils. So there are a number of things that are out there. But, EPA's prediction and projection really weren't as specific as I'd like. I think a lot of it was planting trees.

Question/Comment: It has been estimated that we have about 50 percent of the organic matter in our soils now as we did originally. Theoretically, then, we could add 50 percent more. I'm glad Jim Martin kept harping on population and land use in the context of the climate change. When most of us graybeards were in college, we had about 4 billion or so people in the world. We now have more than 6 billion. And to support 6-plus billion, we have cropland about the size of South America. By the year 2050, we will have 9-something billion. We will have to have another acreage of cropland about the size of Brazil.

Now, back to your comments and whining about development. As we develop in the suburbs and beyond, what kind of land is that? That's the good stuff. That's the flatter stuff. That's the fertile stuff that takes us less energy to produce food on than the land currently in CRP. It would not be in CRP if it weren't highly erodible. So, as we move into those lands increasingly to grow food, to grow corn ethanol, we will have to invest more energy. If we think about the lifecycle analysis, they're typically on sloping lands, so we're going to have more erosion, we're going to increase the size of hypoxia in different parts of the world. So, bully for Jim, to keep emphasizing population and land use and development. Still, I don't think it's talked about nearly enough in the context of climate change and energy consumption. They're all inextricably related.

Panelist: One of my heroes is a guy named Stan Gregory in the Willamette Valley of Oregon, who has done a wonderful kind of overlay project that I was just talking about. You can imagine the Willamette Valley, Oregon's most populous valley, being that pilot joint venture. Here's the snapshot. Here's what the valley will look like in 2020. Here's what it will look like in 2050. Here's what it will look like in 2070. Here's what it will look like in 2100. This is the current development trajectory. If you don't like that development trajectory, it's time to change the policies that drive the incentives and disincentives now. If we deal with development the way we always deal with development, which is kind of a five-year increment, it will never look like a very big deal. And we'll back our way into the future with our eye in the past, and we'll suddenly find ourselves saying, well hell, we would have never wanted to do it this way if we made any kind of strategic decision. But we've got freedom and landowner rights and just the terrible incentive to develop at the local government level, which drives us toward the future. My point is this. The only way you will ever change that future is if you look at it in a big enough time frame to give you actual alarm. You actually think about what you're going to hand out—what your landscape is going to look like in 50 years when you hand it off to your kids. And then you create a political dialogue about whether you like the look of that. If you don't like the look of it, you've got to change the incentives and disincentives that are driving it now. I think Stan Gregory and Dave Hulse are doing better conservation than most of the rest of us because they're dealing with this fundamental core issue.

How do you keep working landscapes? And how do you keep livable communities? And how do you keep good quality water? Their point is this. You could double or triple the population in the Willamette Valley. Depending on how you did it, you would have far lower ecological impacts than the trajectory we're on right now, but that implies putting teeth in our land-use planning system, which, from an incremental point of view, people don't want to wrestle with. That's the core issue on how we'll deal with climate, too—it's where we develop and where we choose not to. That's the only core decision we have to make.

Question/Comment: Thanks to the panel and to all of the people who have held this workshop today. It's been very important and very valuable. Trying to think in terms of leverage points available to us, do you have any reflections on the opportunities to use the price of water in the marketplace as a signal to help shunt development in a decentralized, democratized way as we move forward thinking about climate and development and wildlife?

Panelist: This actually is a beautiful segue from Jim's statements about private property and sprawl development, because it's exactly the same phenomenon where you have a certain number of people highly invested in the status quo, who would be opposed to zoning in the context of real estate development of their precious parcels outside the cities to limit the scope of sprawl. The people who are holding water rights have enormous financial incentives to keep the existing system, however, incredibly dysfunctional and out of touch it is with our ecological systems. And so, there's this gigantic need to reform state water law, and yet nobody wants to touch it because it just seems so daunting. But, you really can't get at the fundamental problem. You saw the models. We're going to have a massive crisis in freshwater, particularly in the western half of this country, but inevitably, across the entire country as a result of climate change and all the extremes of precipitation it brings us. Our water rights system is based on an era when freshwater was abundant, and it's all going to come to a crashing halt at some point. It makes more sense to reform those laws now, rather than to get into a complete crisis situation. But, water trading implies this is a public right that is fully regulated. We're going to have carbon trading, and the trades will be completely overseen by some entity that is accountable to Congress, the Legislature and the Administration. We can't have water rights trading because there are no tradable water rights, and you'd have to go into the individual state legislatures—with a few exceptions—and change those laws to make that feasible. And that's a pretty large project. I encourage people to try, but it's going to take a lot of work.

Panelist: One of the problems you're going to face with that is the fact that people already have those rights, especially in the West, where you have appropriation rights. To change that, I think, would require compensation to all those people who have the rights. If you're going to take away the rights and make them state owned and traded and sold, you're going to have to compensate everybody who has a prior appropriation right. Second, I think in terms of water availability and I'm not a scientist. I read what they say. I think water precipitation patterns—I don't think you can see that far out in terms of what it's going to be. I'm not denying science. I'm just saying that it's very difficult to do that. Warming, you can predict, I don't deny that. Some of these other things, I think, are a little bit more unsettled. I do think that, as I mentioned earlier, a viable, strong agricultural sector provides habitat. It provides carbon sequestration, and it requires water. And, if you're going to take away water from that, others are going to suffer as well. So, I'd think twice about trying to reallocate water.

Moderator: I think we're going to have a very interesting resurgence of people who left the Northeast and the Upper Midwest—the Rust Belt they called it at one time—where we still have water. Everybody's going to be coming back in a few years when they find out there's nothing elsewhere.

Panelist: We have a water crisis in this country. We're going to have twice the water crisis in 50 years. We will reallocate water. The only questions are how do you do it fairly, and how do you do it ecologically sensibly? I believe that the water market and the carbon market will drive conservation and will drive most of our major development decisions in this 100 years we've got coming. I believe that peeling off just a tiny, tiny fraction of the money associated with the carbon market and the water market, would basically fund the conservation landscape in this country. And if it doesn't, we're going to see the collapse of most of the state fish and wildlife agencies as relevant players in this game. That's the future I see. A lot of people think I'm a crazy person, but we'll just see.

Question/Comment: Thanks for providing us with such a provocative discussion.

Someone asked a question about competition, perhaps, between development and climate change, and you've talked a lot about development. One of the answers was, we can't think about habitat conservation without thinking about climate change, which is absolutely true in terms of our planning. But the converse is true, that development causes climate change, and I think a lot of people seem to forget that. And you know, globally, they say, just on forest destruction

alone, 10 to 20 percent of global emissions are caused by that. The United States has gotten a buy. We've cleared all our forests for the last couple hundred years. So, I think reinstituting major climate change as part of our development discussion is really important.

Teeing off of both John's and Jim's calls to action, and I think we absolutely need to do everything in our power and fight like hell to (a) get a climate bill passed, but (b) make sure natural resource adaption funding is part of that. But Congress has passed a really partisan health care bill. The politics are really sucky right now. We might not get a climate bill this year or the next two years, given the partisan politics of Washington. That doesn't mean we have to sit on our hands and just wait for it to come. Through the federal annual appropriations process, and with this new Administration, stuff is starting to get done with the federal agencies. A really hard job of trying to collaborate with nonfederal entities is being done.

Going back to that bureaucratic collaborative question, the Department of the Interior alone has a number of different big picture policy initiatives that need all of our help to be successful. The Landscape Conservation Cooperators are one that has been elevated from the U.S. Fish and Wildlife Service to the DOI bureaus. All their energy stuff is another plank—it's huge, with renewable and fossil fuel. It has direct bearing on all of our wildlife conservation issues, such as Secretary Salazar's vision for chartered landscapes or Great Outdoors America. A lot of those don't have a lot of flesh on them yet. You know, treasured landscapes have at least been a talking point for a year. That doesn't mean these aren't good ideas, and I think it really behooves all of us to get involved with these processes and make them successful. That's my call to action.

One thing we need to do before we do adaptation projects on the ground is make our institutions adaptive. The key thing we've all been talking about is how do you do landscape conservation in partnership. The Fish and Wildlife Service leadership has tried to initiate the Landscape Conservation Cooperatives. I really hope we all figure out how to make those successful.

Moderator: There are a lot of things that we are already doing to contribute to adaptation. Some of the things that we may be able to do aren't going to cost a lot of money. It's just a matter of changing how we do some of the things we are already doing, or just reexamining some of our day-to-day decisions through—I've heard it called—the climate change lens. We can spend a lot of money on a lot of big stuff. That does not excuse us from thinking about climate change in our day-to-day work, in the day-to-day decisions we make, whether it's setting a season on a furbearer, what wetland we protect, or how we put in a new culvert somewhere on a stream crossing, all those little decisions—we talk about a death by a thousand cuts—the flip can work as well. We can make a difference in the little things we do every day, just rethinking them with the contemplation of what will this mean 50 years from now, or how will climate change affect what I'm doing. We don't have the privilege to wait until the big money comes to us to take action. We have to start doing it now, and we don't have to wait for all these big collaborations. We can start it now when we go back to our desks and back to our computers and our day-to-day work.

Question/Comment: I agree completely with that. There's absolutely no question that we need a hell of a lot more money if we're going to try to create a conservation landscape against the development trajectory and the climate change trajectory we're facing. There's absolutely no question about it. That does not relieve us of the responsibility of saying, given our resources, if they were only what we have, how would we be smarter? Dealing with the development juggernaut, how would we be smarter dealing with the climate change that's coming? There are two sayings I'd like to share with you. The first saying is you can't do the new stuff if you keep doing all the old stuff. And you just gotta decide what's most important in the long run. We're doing a lot of micromanagement of game species just because we've gotten used to doing it. We love to do it, we've got a long-standing tradition to do it, and the sportsmen will expect that. Somebody's just got to call it out and say, we're going to do a little less of that. We have to start, I mean, the whole conference tomorrow is about changes that are coming to fish and wildlife agencies, and that we have to be more strategic. We have to say clearly, at the end of the day, the most important decision that any individual or any agency will ever make is what you work on and what you pass on. We're working on some stuff here that doesn't matter very much across a landscape scale 50 years in the front and looking back 50 years from now. We have the opportunity to work on things that will be more significant. We have to make that transition. We have to make that transformation. We have to lead by our example. We can't just sit around and wait for $100 million to land in our lap, and then start planning. Now is our time.

Panelist: Regarding Landscape Conservation Cooperatives, we need all the help we can get to build shared capacity that we can direct across the conservation community, across organizations, across professions. Then, we can begin to define what sustainability and ecological sustainability look like, on large landscape scales but still be able to do work at the site scale, within working landscapes, within protected landscapes, so that we can still do work at the site scale. That will add

up to a larger vision of sustainability within those landscapes. We don't have the capacity to do that now. One of the panelists observed that species response cannot be modeled. I disagree with that. We can model species response. We can't model it very well in many respects, and we need to learn how to do that better. We need to build the capacity to allow us to model species response and be able to predict that. And if we can't model species response, then farmers are in a lot of trouble, because the last time I checked, corn was a species of the genus *Zia*. So if we can't predict species response, then we're all in trouble. We need to build new institutions, we need to build capacities and we need to do that together.

Within the context of the current appropriation cycle, there's a lot to be optimistic about. I think that when we articulate these needs well, the political system is responding to us right now. It's not ultimately what's needed. Ultimately, we need a kind of transformational change in how we're deriving and applying funding. But in the near term, we can be successful if we're halfway smart and a little bit lucky.

Panelist: I was talking about was species responses, and you can't model them. You don't know whether species are going to adapt to a habitat or where they're going to go. You could try modeling that. The problem is that, if you're trying to develop working landscapes, if you're working with private landowners where these species live right now, and you're wrong, then you've spent a lot of money on easements or you've spent a lot of money buying land that species may not ever inhabit. So again, it has to be something that's very carefully done. Adaptation is a process, not an event.

Panelist: Pulling things down to the more local scale, one of the things we are trying to do in Oregon, and I know other agencies are too, is recognize we have some direction from our leadership that climate change will be part of every program. We need to help assure that every work plan, every wildlife area, every hatchery, everything, every entity within our agency is going to be looking at climate change. For example, one of the things that we're doing with our wildlife areas right now is asking the managers, if you're building your budget for maintenance and infrastructure for the next 20 years, what do you see as the changes based on climate, especially for our wetland wildlife areas? What kind of infrastructural changes will you need or anticipate to be able to address changes 20 years out or more. As agencies, federal or state, there's a way to build in climate change without changing a lot of what we do, but tweaking how we do it.

Question/Comment: I'm a wildlife biologist here in Wisconsin for the Department of Natural Resources. I'm actually just looking for some career counseling. I still don't know really what I want to be when I grow up, and I've been wondering whether I should dedicate myself to working on control of human population, whether to take up a hammer for Habitat for Humanity, whether I should work for social justice and fair wages. I feel like, where I live in Madison, folks who don't have a good home or roof over their heads, or are having trouble making it from paycheck to paycheck really don't give a rip about climate change or wildlife. So, sometimes I feel like, as a state biologist, I should be doing something different. I just wonder, as we talk about coalition partners, whether we should be even broadening our coalitions, to make sure that basic human needs are met. That might put us in a better position to be able to be effective dealing with climate change and wildlife.

Panelist: I would certainly agree with that. I do think some things are more important than others. And I do think basic human needs is one of those.

Panelist: I agree with you, but say the opposite of what Rick just said. Because, if we carried out our work well, it would be obvious that we care about people, and particularly people in need. I look at my work as the fair distribution of resources. What may be wrong with our environment is what's wrong with our social system. And so, if we can work on fair distribution of resources, then I think we can hold up our heads and could go to the inner city and explain and actually work on habitat. And they would say I agree with you. I care about habitat, too. I care about where I live. That's what this comes down to. I think this distinction we made between wildlife habitat and people habitat is just off, and it has really hurt us over the years. People think that they are two different projects.

Panelist: I'll just say, if you want to make yourself feel good about working in the wildlife community, go spend some time working with the people that are trying to feed the homeless and shelter the homeless. Then you feel really lonely.

Panelist: My advice is you ought to do what's meaningful and fun for you. But if we wait until we've dealt with hunger and world peace and population control to work on wildlife, we'll never get it done. So, the issue really is working in parallel and addressing an issue that has political traction across the landscape, not just for hunters, fishermen and wildlife enthusiasts. That's why I like to talk about healthy watersheds. I like to talk about healthy communities. I like to talk about working landscapes. I like to talk about conservation that makes sense for private landowners. Then we can make

the translation back to ducks and deer and walleyes and trout. They're not necessarily driven by that, but they care about healthy communities. Your comment really is right on track. If we can't relate our work over time and over space to healthy communities, we've missed the boat.

Panelist: You know, it's really hard to say anything that's a wrap-up because it is such a great conversation. The only thing I can say is the National Wildlife Federation is hosting a happy hour at 7:00 o'clock. If you really want to hear this group get profound, come there about an hour into it.

Panelist: I echo that as well. Thank you very much for inviting us, and as you can see, this whole issue of climate change is not an easy one. It is very complicated. It's going to require a lot of participation, a lot of collaboration among a lot of groups. And, hopefully, we can get that done.

Panelist: My thanks, also. I want to leave folks with a quote from Ghandi from the 1940s: "You must be the change you wish to see in the world."

Panelist: I'd like to congratulate the Wildlife Management Institute, Association of Fish and Wildlife Agencies, the American Fisheries Society and The Wildlife Society for leading the charge that we're talking about things that matter more now. We're having symposiums like this, even though some people would like us to shut up. We're talking about them and we're engaging them. This is the work we were born to do. And no matter how much we might disagree on an individual policy, there is something we will always have in common--we love where we live and we care about our kids. We can translate this whole learning process back to the way where we're going to live is going to change, maybe change, there'll be lots of surprises. We won't model it perfectly, I guarantee you. But we're going to try. We know the kind of direction of the change, and can start getting ready for that. That's the work of our profession right now. We're not afraid to talk about it, and we're not afraid of the controversy. We have the courage to try a lot of stuff, and this is the stuff we should be talking about. So I congratulate everyone in this profession for leading where we need leadership.

Moderator: I would like to thank you for sharing the afternoon with us, for being patient, for asking very good questions. I invite you to the National Wildlife Federation reception, and we can pick up the conversations on a one-to-one basis. Thank you all.

Workshop.
Structured Decision Making in the Face of Uncertainty: Adaptive Management for Climate Change

Abstract: Wise Decision Making for Climate Change Adaptation

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Climate change represents a source of uncertainty that is of great concern to managers of natural resources. However, it is important to acknowledge that most decisions in natural resource management are made in the face of uncertainty. Approaches such as adaptive resource management (ARM) have been developed to deal with decision making under uncertainty, and we believe that these methods can be extended to deal with the added uncertainty associated with climate change. Our focus is not on mitigation and management of climate change itself (although ARM provides an excellent framework for these decisions as well), but on existing management programs that may require modification because of climate change.

Discussions of ARM frequently identify four sources of uncertainty: environmental variability, partial controllability, partial observability and structural uncertainty. We do not view climate change as a new source of uncertainty, but instead as a form of environmental variation that has the potential to exacerbate or otherwise influence each of the other sources of uncertainty. With respect to management, each of the components of the ARM process can be influenced by climate change.

Objectives (e.g., population goals or desired population sizes) that are appropriate for one point in time (e.g., the present) may not be realistic in the future. Climate-induced changes in carrying capacity may cause a population objective that is reasonable today to be completely unattainable in the future. A reasonable response to such changes in the ability of habitats to support certain numbers of animals may be to change objectives accordingly, an approach that has seen little historic use.

Management actions represent the set of alternatives considered for use at each decision point. Climate change may cause us to re-evaluate existing sets of alternatives in order to meet new challenges imposed by climate change. For example, management of a population of an endangered species inhabiting a low-lying island may involve consideration of translocation to other higher sites, an action that would not be considered were it not for anticipated sea level rise.

Models of system response to management actions are required in order to make good decisions. Current models frequently incorporate key environmental variables and characterize them as arising from stationary processes. There is variation over time, but this variation is characterized by a process that does not vary over time. A key feature of climate change is nonstationarity, or directional changes in processes characterizing environmental variation. One possible response to nonstationarity is to incorporate key environmental state variables into the system models, thus providing a basis for modeling dynamics of these variables. This approach is reasonable for environmental processes that we can identify as important system drivers and that we can model.

For environmental variables that we do not recognize as important or cannot model, we might be forced to adopt the ad hoc approach of exploiting the double-loop learning step of ARM by managing over short time horizons (e.g., 5 to 10 years), with the recognition that we will need to revisit the model set frequently as models become progressively more inadequate as predictors. Under this approach we will need to emphasize rapid learning during each period, recognizing that new models will need to be based on recent information, rather than on long-term historical data sets.

We also need to consider new approaches to *optimization algorithms* in the face of nonstationary environmental change. For situations in which key environmental drivers can be incorporated into system models, dynamic optimization approaches can be used, but will produce time-specific solutions, rather than stationary ones. For situations in which we do not know enough to incorporate changing environmental drivers into models, we will need to optimize or develop policies with short time horizons. Under this double-loop approach, the optimization and policy development should emphasize leaving the system in a robust state at the end of each time horizon, so as to not reduce flexibility of decisions in the next sequence of time steps.

Finally, *monitoring programs* may require modification because of climate change. Changing geographic distributions of animals may warrant new stratification efforts and even shifts of survey boundaries to include range expansions and contractions. Inferences from some monitoring programs depend on stationary detection processes, such that detection probabilities may vary over time, but always according to the same underlying distribution. Phenological and associated behavioral changes associated with climate change may induce directional variation in detection probabilities that would lead to poor inferences from methods assuming stationarity. In such cases, the appropriate response will be to modify monitoring programs to collect the ancillary data needed to estimate detection probability directly, removing the need for specific assumptions about its temporal variation.

Thus, although each component of ARM may be influenced by climate change, we can develop appropriate responses with existing ARM frameworks. Though substantive challenges remain, we advocate ARM as a decision process that will be especially useful for managing in the presence of climate change.

Abstract: Changing Climates and the Incorporation of Adaptive Management into Our State Wildlife Action Plans

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The loss of biodiversity is repeatedly identified as the primary threat to long-term ecosystem resilience, with the potential to not only undermine natural ecosystem function, but threaten human socio, political and economic stability. Concerns about biodiversity increasingly have led to efforts to reduce the rate of species loss, but despite the good intentions of numerous public and private organizations, the number of species at risk continues to rise. In the United States alone, there are currently more than 1,200 species listed as threatened or endangered, with potentially thousands more at risk. Moreover, it is becoming increasingly apparent that changing climatic conditions may accelerate species loss, while ironically, the maintenance of species diversity may be crucial in efforts to both mitigate and adapt to new climatic conditions. Given the current and pending challenges of conserving biodiversity, there is an ever increasing need to develop strategic conservation efforts that proactively address the continuing threats to biodiversity, and despite numerous attempts to initiate large-scale conservation implementation, there are surprising few successful examples.

In 2002, Congress created the State Wildlife Grants (SWG) program to provide funding to states with the goal of maintaining biodiversity, and avoiding the costly and controversial regulations that accompany listing under the Endangered Species Act. To receive SWG funds, each state developed a state wildlife action plan to articulate their vision for the biodiversity conservation. In the summer of 2009, the U.S. House of Representatives further challenged the states by requesting the inclusion of language and approaches for mitigating and adapting to changing climates and the potential impacts to biodiversity. While not explicitly outlined by Congress, the elements central to the SWG program form the foundation of adaptive management, a management paradigm that aims to continually assess management practices as a means to address uncertainty both in knowledge and outcome. The use of adaptive management for managing declining species, especially in light of climate change, may be particularly appropriate, as adaptive management explicitly acknowledges and attempts to address the uncertainty inherent in managing species where basic biological information and an understanding of appropriate management strategies is too often lacking. Moreover, the uncertainty inherent in predicting future climatic conditions and the need to act to mitigate and adapt to new and ever changing climatic conditions are ideally suited for implementation of adaptive management. Indeed, the potential benefits of incorporating adaptive management as a paradigm were not lost on SWG planners, as nearly every state plan mentions adaptive management; yet, despite the awareness that adaptive management may function well in meeting the goals outlined by Congress, the development of an effective adaptive management framework is challenging.

In an effort to assess the extent to which states embraced adaptive management in the initial development of their plans, and as a means to help states begin to consider how adaptive management approaches may assist in managing changing climate conditions, I reviewed 53 plans from all 50 states, the District of Columbia, and the territories of Puerto Rico and Northern Marias Island. I evaluated plans based on the extent to which they developed sound adaptive management principles expressed through explicit programmatic and project-level management frameworks and how this approach may poise states for coping with climate change.

Despite an obvious awareness by the states that adaptive management was an effective method of meeting the goals of the SWG program, it was clear that the development and incorporation of explicit adaptive management approaches within each plan remained elusive. Only about 20 percent of the plans included a framework for how adaptive management would be implemented at the project level within their state. There was, however, considerable support across plans for further development and implementation of adaptive management. Unfortunately, there are also numerous obstacles and constraints. Some obstacles highlight the enormity of the challenge the states face in biodiversity conservation. For example, many plans communicated the challenge of decision making, from identifying imperiled species and habitats to outlining alternative management strategies. Making complex decisions with enormous implications is challenging, but these obstacles can be overcome by incorporating decision tools that increase the structure and transparency of the decision process and thereby the defensibility of outcomes. This is particularly true when decisions are made with a great deal of uncertainty, as would be expected for decisions concerning mitigation of or adaptation to climate change. Other obstacles involve more dogmatic shifts in the way we think about, fund and implement management. As a reactionary society, many natural resource management decisions are made in response to current sociopolitical perceptions of resources, but adaptive management calls for a more proactive approach. The nature of climate change in particular, with the time lags inherent in mitigation and adaptation, will require a proactive management approach to ensure that desired outcomes are achieved well in advance of projected changes.

Finally, although Congress explicitly identified monitoring as a key element of the SWG program, prioritizing monitoring from both a budgetary and a design perspective remains a challenge. Again, climate change in particular warrants support for more stringent design of monitoring efforts. Unlike other perturbations to the environment, climate change has the potential to alter ecosystems so completely as to in some cases remove the opportunity for returning systems to historical states. Which is not to say environments cannot be maintained or restored, but rather that the nature of pristine conditions may change for a location, creating a continually moving target which will require extensive monitoring efforts to not only identify current conditions and ecosystem drivers, but also potential future stable states.

Despite the obstacles, states have a rich history of natural resource management success, andby building upon their strengths and improving upon their weaknesses they can overcome the challenges and ensure the conservation of biodiversity. By furthering the incorporation of adaptive management principles in their conservation plans and outlining the decision-making process more explicitly, states will be poised to meet the pending challenges of maintaining biodiversity in a changing climate.

Abstract: Adapting Adaptive Harvest Management for Climate Change

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Adaptive Harvest Management (AHM) is the current process for setting annual duck hunting regulations in the United States. AHM is based on the principles of adaptive resource management and was developed to provide a structured framework for informed regulatory decision making in the face of uncertainty. AHM was initially formulated for mid-continent mallards (*Anas platyrhynchos*), however, its underlying principles now are applied to three mallard stocks and several additional duck species. While the principles of adaptive resource management are common to all AHM implementations, the objectives and analytical techniques vary. AHM recognizes and accounts for four sources of uncertainty including: environmental variation, structural uncertainty, partial observability and partial control. Methods for characterizing, accommodating or controlling for these forms of uncertainty have relied, traditionally, on assumptions of long-term system stationarity. Climate change is expected to cause nonstationarity or directional shift in system dynamics, and some wetland habitats critical to waterfowl appear particularly vulnerable to climate effects. Nonstationary system dynamics may exacerbate all forms of uncertainty facing waterfowl managers and will require modifications to all elements of AHM. Harvest management objectives must realistically account for uncontrollable climatic effects on the harvest potential of populations and should be integrated with habitat conservation objectives. Integrated harvest-habitat decision frameworks that admit an expanded range of management options (i.e., harvest regulation, habitat management and policy options) will increase in importance as climate impacts interact with other population stressors.

We describe several adjustments to modeling frameworks in response to nonstationary environmental variation. Similarly, we discuss alternative approaches and challenges to optimization in the face of system change, including a possible focus on short time horizons. Finally, we describe potential changes to monitoring programs that may be necessary to identify and accommodate shifting waterfowl distributions and migration chronology, as well as shifting spatial patterns in demographic processes.

Abstract: Using a Decision Analysis Framework to Create an Integrated Model of the Effects of Climate Change in the Yakima River Basin

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Building on work conducted over the past several years, a U.S. Geological Survey (USGS) interdisciplinary team from the Western Fisheries Research Center, Columbia River Research Laboratory (CRRL), Fort Collins Science Center and the Washington Water Science Center are using the concepts of decision analysis and structured decision making to develop a model that links climate, hydrologic, bioenergetics, social and economic models into a comprehensive framework for modeling and understanding the complex and interrelated effects of climate change and water management decision making on the quality of life in the Yakima River Basin (YRB). A one-week decision analysis-framing workshop was held in July 2009, which brought together decision makers and stakeholders working on water management issues in the YRB and the USGS scientists conducting research in this area. The group developed a shared conceptual framework that can be used to (a) help ensure that the planned USGS science work produces information that is useful to decision makers, and (b) place this ongoing work and potential future work in the larger context of water management in YRB.

The USGS investigators for the YRB project recognized that to support water managers and water management decisions effectively, it is essential that the conceptual model be:

- capable of modeling *outcomes that are of interest* to the water managers and other decision makers, so that the model not only provides meaningful information, but also provides that information in form and context that is meaningful to the decision makers making tradeoffs between alternative strategies;
- capable of modeling the potential effects *of alternative water management strategies* so that the model provides meaningful information that can help differentiate between those strategies; and
- based *on sound science, data and modeling,* including acknowledgement and logically sound treatment of key uncertainties such as the impact of climate change.

The conceptual model developed by the workshop participants contains all three of the elements described above. The outcomes of interest to water managers and stakeholders include maximizing the environmental benefits of water management decisions, minimizing any adverse effects on public health and safety from such decisions, and maximizing the positive economic and social benefits to the local communities from water management decisions. These outcomes are fairly general, and in future modeling, more detailed performance measures or metrics may be required. In adaptive management, it is important to have metrics that can be estimated, modeled and monitored, and we believe it is critical that those more detailed metrics derive from and inform estimates of the more general objectives, which more directly relate to stakeholder and decision maker interests.

Alternative water management strategies considered in the development of the conceptual model include potential reservoir expansions, modifications to how reservoirs are managed, expanded use of groundwater and water conservation strategies, as well as options aimed directly at mitigating adverse effects on fish populations. These alternatives were taken directly from the Yakima River Basin Integrated Water Resource Management Alternative (Final EIS), June, 2009 (Washington Department of Ecology), in order to maximize the utility of this conceptual model to other ongoing efforts in the YRB.

Finally, some of the specific areas where sound science, data and modeling are required include understanding how climate forecasts or scenarios affect regional air temperatures and precipitation (requiring downscaled climate models); how those changes in temperature and precipitation affect stream flows and water temperatures throughout the year (hydraulic modeling, by Mark Mastin and Frank Voss of the Washington Water Science Center); how changes in water temperature and flow affect habitat quality (habitat modeling, by Jim Hatten of the CRRL); how temperature changes affect fish growth (bioenergetics modeling, by Matt Mesa and Jill Hardiman of the CRRL); how habitat changes and fish growth affect overall fish population health (fish cohort modeling); and finally, how changes in fish populations

impact the local economy and the quality of life of YRB residents (economic and social modeling, by Lynne Koontz, Jessica Montag and Jennifer Thorvaldson of the Fort Collins Science Center).

Effects and Lessons Learned

The decision analysis-framing workshop and conceptual model development had direct and immediate impacts on planned 2010 science work in the YRB. As a direct result of stakeholder interactions and the conceptual modeling effort, the USGS has:

- added temperature modeling of the tributaries and the lower river;
- shifted to steelhead as a species of concern for modeling; and
- received additional support and in-kind funding from Columbia River Inter-Tribal Fish Commission.

Future work will continue to emphasize the ability to model effects of alternative water management options as adaptation strategies to effects of climate change, and to include consideration of the economic and social effects of changes in fish population health on the local communities.

More generally, the workshop and the conceptual model highlight the fact that climate change and responses to climate change have the potential to lead to significant impacts at a very broad level. Decision analysis provides a useful framework for structuring large integrated problems and showcases the need to link physical, biological, social and economic models into a coherent conceptual model, and to produce outputs and results in terms that are meaningful to those making decisions and to people who will be affected by those decisions. The process of engaging decision makers and stakeholders in developing the conceptual model greatly improves the utility of science project results and facilitates prioritization of research efforts, by incorporating decision-maker interests and needs.

Abstract: Preparing for Climate Change Today in Light of the Uncertainties of Tomorrow

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The goal of ecologically sustainable water management is to protect the biological integrity of ecosystems while meeting human demands for water. There are potentially multiple competing uses for water: municipal and industrial water supply, hydropower, navigation, recreation, and environmental flows for ecosystems. Dams and reservoirs were built to support human demands and to reduce flood damages. However, the reduction of hydrologic variability has had a negative impact on riparian ecosystems, since species have adapted to the natural flow variability.

Climate change has the potential to affect many aspects of aquatic resources and could increase competition for a limited water supply. The frequency and magnitude of hydrologic extremes may change. More summer evaporation and reduced summer flows are likely. Higher water temperatures may weaken the ability of freshwater plants and animals to tolerate other changes and may lead to a temporal shift in fish migration.

Climate change is one of many uncertainties and future changes affecting water and resources management. Future land use changes may affect hydrology, and population increases and other demographic changes may increase water demand. Invasive species affect native ecosystems. The rate and magnitude of these changes and how they interact are uncertain. Climate change may exacerbate the effects of other drivers on varying scales. Information from global climate models and down-scaling to regional and local scales is highly uncertain. We cannot predict these future changes, so we have to manage the uncertainty. Adaptive management provides a process to make changes over time as changing conditions are observed.

The Savannah River will be used as a case study for how adaptive management can be used for water management. The river is one of the sites in the Sustainable Rivers Program, which is a partnership between The Nature Conservancy (TNC) and the United States Army Corps of Engineers (USACE) formed to restore and preserve rivers across the country.

The “Savannah River Process” is an example of a structured decision process that can be used to balance competing objectives in the face of uncertainty. The first step was a scientific report developed by a team of scientists to present the current state of knowledge and develop a conceptual model of the interaction between flows and ecosystems. A workshop was then held to construct environmental flow requirements for the Savannah River. The goal was to meet the needs of the native species enough of the time to sustain their current condition. This was the beginning of the adaptive management process, which led to implementation by USACE, measuring the effects of this ecosystem experiment, and then providing feedback on ecosystem responses.

An important step in the process was mapping seasonal streamflow patterns onto life histories of biological targets to determine environmental flow requirements. Workshop participants developed a flow prescription for the different life stages of key species, such as American shad, and for different habitats. The approaches developed by TNC focus on three key aspects of the natural river flow regime. Low flow conditions occurring throughout the year determine the availability of habitat for aquatic organisms and have great effect on water quality. Occasional high flow pulses enable fish and other aquatic organisms to move around to access new food sources, reset water temperatures, and improve dissolved oxygen conditions. Some degree of flooding is also important in shaping the river channel and floodplain habitats, enabling fish to access the floodplain for spawning and additional food, and maintaining healthy, diverse floodplain forests.

The Altamaha River, a large, coastal plain river to the south of the Savannah that is relatively unimpacted by dams, was used as a reference site to evaluate the effects of pulse flow restoration. Fish floodplain communities in the Altamaha and Savannah Rivers do not differ dramatically, although some Savannah sites may be aberrant. There was some evidence that floodplain invertebrate communities along the Savannah River were becoming more similar to the Altamaha after two years of pulse restoration.

In 2006, the biological monitoring was expanded to include a tag and release study on federally endangered shortnose sturgeon. Fish were tagged and released at the dam in hope of measuring their passage through the locks and dam. The controlled flood was modified to create optimal conditions at the dam for passage. However, no tagged sturgeon went through the dam. All tagged fish went back to the estuary of their winter habitat; one fish left the system and swam into the Santee-Cooper River in Charleston. Although physical flow conditions were right to facilitate fish passage, temperatures were not. Water temperatures indicate that the pulse from the dam was very cold, clear water,

because reservoir releases can only be made from the bottom of the lake. This cold water was probably responsible for sending migratory fish back downstream into their winter habitat. These results show the learning that can occur through an adaptive management process.

In general, the "Savannah Process" worked for all parties involved for developing a flow prescription. USACE implemented parts of the flow prescription that were authorized by the temporary deviation to their water control plan. Monitoring was conducted by Georgia Department of Natural Resources, South Carolina Department of Natural Resources (SCDNR), University of Georgia, Savannah State University and TNC. The SCDNR is working with the USACE Savannah District to use the same process for climate change adaptation on the Savannah River.

There are some challenges to further implementing adaptive management across the country. Adequate funding is a challenge. Federal funds for monitoring are limited, and most state fish and wildlife agencies lack resources for monitoring. For climate change adaptation, it will be necessary to conduct long-term monitoring of changing conditions.

The Savannah River process was implemented in the context of existing authorities. Getting a temporary deviation is relatively easy, as long as National Environmental Protection Act documentation is done, there are no significant adverse impacts (finding of no significant impact [FONSI]), and there is state and federal consensus. Revising the water control plan is possible, but requires an in-depth study. This will require public consultation and an environmental impacts statement, which can be expensive and time consuming if contentious. Major changes in reservoir purposes may require Congressional approval.

Fish and wildlife directors and water managers generally do not have the luxury of waiting before they must make difficult management decisions regarding natural resources. State fish and wildlife agencies and state/federal water managers should work together to develop alternatives in water management strategies (e.g., the timing and duration of water releases) and monitoring. This will allow flexibility to reevaluate decisions that evolve over time in response to new information and allow fish and wildlife managers and water managers to adapt quickly to the nonstationarity of climate change.

Abstract: Workshop Summary

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Resource managers often are required to make tough decisions when the science is uncertain. These decisions must be defensible even when it is uncertain what the full impact of the problem will be and what impacts (both intended and unintended) the solution may have. There is a growing scientific consensus that a major shift in global climate is underway and that this climate shift may profoundly impact natural resource management. Adaptation to climate change will be especially challenging because decisions often will be made using an incomplete understanding of climate change impacts, particularly at the local level. Adaptive management and structured decision making are critical tools for making decisions with incomplete information and high levels of uncertainty. Structured decision making is a decision analysis process that can help overcome challenges by breaking down difficult decisions into components of the decision process, clarifying issues of agreement and disagreement among stakeholders. Adaptive management is a special case of structured decision making where decisions are made repeatedly. Adaptive management is a learning-based process where management actions are used to learn about the resource. Through an iterative process of management, monitoring and evaluation, a greater understanding occurs of the resource and of management consequences.

Recognizing the importance of adaptive management and structured decision making, the Association of Fish and Wildlife Agencies (AFWA) Science and Research Committee is developing a series of workshops for state fish and wildlife agencies that promotes a process of making decisions in a scientifically defensible manner. The first workshop focused on using adaptive management and structured decision making for invasive species management. This workshop was organized in collaboration with the AFWA Invasive Species Committee and was held at the 2009 North American Wildlife and Natural Resources Conference. This second workshop focused on developing processes to manage and learn about natural resource responses to climate change. This workshop was organized in collaboration with the AFWA Climate Change Committee.

Registered Attendance

Alberta
Brett Calverley, Deanna Dixon, Samantha Song

Alaska
Douglas Alcorn, Timothy Bowman, Tina Cunning, Anthony DeGange, Christopher Estes, Jimmy Fox, Bob Gerlach, Maria Gladziszewski, John Haddix, Geoff Haskett, Cynthia Jacobson, Wini Kessler, Doug Larsen, Tom Liebscher, Denby Lloyd, Jeff Mason, Matthew Moran, Dale Rabe, Kevin Saxby, Mark Sledge, Eric Taylor, Douglas Vincent-Lang

Alabama
David Hayden, Charles Sharp

Arkansas
David Goad, Tim Kizer, Donald McKenzie, Matthew Warriner

Arizona
Aaron Alvidrez, Josh Avey, Scott Bonar, Jason Corbett, Daniel Garcia, Eric Gardner, John Hockersmith, Mark LaBarbera, Larry Riley, James Douglas Ripley, Mike Senn, San Stiver, William Van Pelt, Larry Voyles

California
Arlene Arnold, Sandra Baldwin, Cheryl Carrothers, Kirsten Christopherson, Rhys Evans, Bob Frost, Barnie Gyant, Raymond Hasey, Judd Howell, Nic Huber, Edie Jacobsen, Manny Joia, Rick Kearney, Dawn Lawson, Renne Lohoefener, Robert Lovich, Lisa Markovchick, Sonke Mastrup, Tom McCabe, John McCamman, Chris Moi, Randy Moore, Nicole Olmsted, Jeff Opdycke, Amber Pairis, David-Bryden Pease, Jacqueline Rice, Dr. Bruce Rideout, Dan Robinette, Rudolph Rosen, Martin Ruane, Robert Schallmann, Grace Smith, Marie Strassburger, Valerie Vartanian, Robert Wolf, Christy Wolf, Darryl York, Larry Zimmerman

Colorado
Lee Barber, Carol Beidleman, Delwin Benson, Robert Brozka, Richard Bunn, Rick Cables, John Cantlon, Lew Carpenter, David Chadwick, Larry Clark, JohnCornely, Tom DeLiberto, Scot Donato, Peter Dratch, James Dubovsky, Wayne East, Mike Fall, Josh Goldstein, Jeffrey Green, Stephanie Gripne, Steve Guertin, Jay Hestbeck, Matt Hogan, Kimberly Kaal, Lynne Koontz, Elaine Leslie, Seth McClean, Brian Mihlbachler, Amanda Peyton, Krystal Phillips, Joanna Prukop, Eileen Regan, Thomas Remington, Stan Rogers, Pamela Roth, David Sharp, Karen Stackpole, Casey Stemler, Alexandra Sutton, Mark Vandever, R.E. Vann III, Jeff Ver Steeg, Tammy VerCauteren, Noreen Walsh, Madeleine West, Kenneth Wilson, Melanie Woolever,

Connecticut
Jim Curcuruto, Chris Dolnack, Brian Hoffmann, Lawrence Keane, Rick Patterson, Stephen Sanetti, Melissa Schilling

Delaware
Eugene Greg Moore

District of Columbia
Maria Arnold, Bryan Arroyo, Dan Ashe, Carol Bambery, John Baughman, Michael Bean, Todd Bogenschutz, Marc Bosch, Wilhelmina Bratton, Gordon Brown, Douglas Burdin, Arpita Choudhury, William Clay, David Cleaves, Jeff Crane, Eugene DeGayner, Amielle DeWan, Jere Dick, Chris Dionigi, Jim Dryden, Matt Dunfee, Naomi Edelson, Peter Egan, Terrell Erickson, Dwight Fielder, Danielle Flynn, Tom Franklin, Gary Frazer, Nelson Freeman, Herbert Frost, Michael Fry, Dave Gagner, Caroline Garrett, Rowan Gould, Deborah Hahn, J. Christopher Haney, Mark Humpert, Mike Ielmini, Bob Irvin, Chris Iverson, Frank Jenks, Laurie Jodziewicz, Gary Kania, Chad Klinkenborg, John Kostyack, Richard Krause, Amy Krause, Faye Krueger, Dan Kugler, Anne Law, Jennifer Lee, Carol Lively, Matthew Long, Laura Maclean, Noah Matson, Andrew McDaniels, Bill McGrath, Tom Mendenhall, Martin Mendoza, Nikki Moore, John Moore, Raul Morales, William Moritz, Laura Muhs, Priya Nanjappa, Mark Nechodom, Peter Nelson, Angela Nelson, Ryan Orndorff, Thomas Peterson, Teresa Radcliffe, Ronald Regan, Terra Rentz, Ryan Roberts, Alan Rowsome, Jessica Rubado, Jen Mock Schaeffer, Paul Schmidt, Anna Seidman, Gregory Siekaniec, Dean Smith, William Spicer, Bruce Stein, Elizabeth Stevens, Virginia Tippie, Albert Todd, Geoff Walsh, Bryant White, Dan Wrinn, Anne Zimmermann

Florida
Tim Breault, Noreen Clough, Diane Eggeman, Mark Fredlake, Wendy Jones, George Kenny, Bob Miller, Mike Nunley,Allen Richmond, Rob Southwick, Bill Tate

Georgia
Liz Agpaoa, Tim Beaty, Robert Brooks, Michael Conroy, Cynthia Dohner, John Fischer, Dan Forster, Dave Glass, Dennis Krusac, Gregory Lee, Mark Musaus, Brad Nelson, David Schmid, Colin Shea, Emily Jo Williams

Hawaii
Lance Bookless, Paul Conry

Iowa
Patricia Boddy, Kim Bogenschutz, Joe Larscheid

Idaho
Michele Beucle, Cal Groen, Tom Hemker, Virgil Moore, Sal Palazzolo, James Peek, Terrell Rich, Mike Schlegel, J. Michael Scott, Katherine Strickler

Illinois
Hal Balbach, John E. Buhnerkempe, Dick Gebhart, Sharon Geil, William Glass, William Goran, Tim Hayden, Jim Herkert, Matt Hohmann, Matthew Lechner, Marc Miller, Mark Pranckus, Anngelia Richter, John Rogner, Thomas Smith, Wade Spang, Renee Thakali

Indiana
Dave Case, Phillip Cox, David Howell, Zachary Lowe, Mitch Marcus, Jon Marshall, Mark Reiter, Phil Seng, Richard Winstead

Kansas
Michael Christensen, Michael Houts, Eric Johnson, Sheila Kemmis, Joe Kramer, Murray Laubhan, Thomas Loughlin, Rob Manes, Mike Mitchener, Doug Nygren, James Pitman, Robert Robel, Tina Seemayer, John Silovsky, Chris Tymeson

Kentucky
Tom Bennett, Margaret Everson, Jonathan Gassett, Tim Guilfoile, David Ledford, Darin Moore, Brian Smith

Louisiana
Jimmy Anthony, Mark Gates, Mariamar Gutierrez Ramirez, Scott Knaus, Janine Powell

Massachusetts
Wayne MacCallum, Sherry Morgan, John Organ, Thomas Poole, Stephanie Schmidt, Lisa Sorenson, Wendi Weber

Manitoba
Michael Anderson, Rick Baydack, Bob Carmichael, David Howerter, Henry Murkin, Jeff Nelson

Maryland
Lowell Adams, Adrienne Antoine, Lowell Baier, Laura Bies, Scott Boomer, Janet Bucknall, Roger Griffis, David Hoskins, Michael Hutchins, Jenna Jadin, Mark Koneff, Richard McCabe, Dwayne Meadows, Melissa Mertz, Steve Meyers, Thomas Myers, James Nichols, Paul Padding, Bruce Peterjohn, Charlie Rewa, Tim Richardson, Alan Risenhoover, Jill Rolland, Greg Smith, Jacqueline Smith, Angela Somma, Susan-Marie Stedman, James Swift, Darryl Walter

Maine
Ken Elowe, Dan McAuley, Linda Rivard

Michigan
Brian Bogaczyk, David Brakhage, Dale Burkett, Jordan Burroughs, Matthew Cole, David Ewert, Robert Hoffman, Philip Huber, Becky Humphries, Heather Keough, Melinda Koslow, Lucas Langstaff, Dave Maercklein, Russ Mason, Dave Newhouse, Rebecca Pearson, Amber Roth, Mark Sargent, Sharon Schafer, Jim Sobrack, Greg Soulliere, Gildo Tori, Tom Walter, Tina Yerkes

Minnesota
Jay Brezinka, Ryan Bronson, Tim Catton, John Christian, Pat Conzemius, Tom Cooper, Alan Dohmen, Kathy Doncarlos, Joseph Fargione, David Fulton, Douglas Grann, Ryan Heiniger, Steve Hirsch, James Kelley, Tim Lewis, Tom Melius, Kevin Miton, Tim Moser, Harvey Nelson, Dave Nomsen, Barbara Pardo, Don Pereira, Dave Schad, Jamie Schrenzel, Dennis Simon, Brian Stenquist, Bill Stevens, Jeffrey Stoner, W. Daniel Svedarsky, Chuck Traxler, Howard Vincent, Charlie Wooley, Rick Young

Missouri
Tom Dailey, DeeCee Darrow, Kenneth Rex Ennis, Max Ethridge, Ray Evans, John Hoskins, Keith Jackson, Brad Jacobs, Kirk Keller, Jeff Lampe, Bill McGuire, Lynda Mills, John Schulz, Paul Strong, Ginny Wallace, Megan York-Harris, Daniel Zekor, Bob Ziehmer

Mississippi
Pam Bailey, Eric Britzke, Rich Fischer, Mark Ford, Pete Heard, Curtis Hopkins, Richard Lance, Frank Lockhart, Chester Martin, Tom Moorman, Michael Passmore, Ed Penny, John Tirpak, William Uihlein, Antisa Webb

Montana
Keith Aune, Jack Blackwell, Jack Blackwell, Rob Brooks, Daniel Casey, Jonathan Derbridge, Lisa Flowers, Bruce Fox, William Geer, Theresa Hanley, Jon Haufler, Jeff Herbert, Lorin Hicks, Tom Hinz, Mitch King, Sandy Kratville, Paul Krausman, Darren Long, Ken McDonald, Mary McFadzen, Jack Reneau, Dave Risley, Tony Schoonen, Christian Smith, Dave Smith, T.O. Smith, Land Tawney, Tom Toman, Tom Toman, Eric Tomasik

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Doug Bliss, Richard Elliot, Keith McAloney

North Carolina
Charles Brown, Bob Brown, David Cobb, Robert Curry, R. Steve Dial, Kim Fleming, Chris Long, Mallory Martin, Robert Montgomery, Gordon Myers, Kimberly Pritchard, John Ward,

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New Jersey
David Chanda, John Janelli, John Joyce, Paulette Nelson

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Sharon Coe, Octavio Cruz Carretero, Don DeLorenzo, Carol Finley, Trish Griffin, Steve Helfert, Junior Kerns, Elizabeth Knight, James S. Lane, Jr., Lucas Oligschlaeger, Jim Ramakka, Janet Ruth, Tod Stevenson, Benjamin Tuggle, Gail Tunberg,

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Anita Barstow, Andrea Crews, Richard Hatcher, Mike O'Meilia, Joshua Richardson, Melinda Streich

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Susan Humphrey, Cameron Mack

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John Alexander, Kimberly Anderson, Ronald Anglin, Brad Bales, Brad Bortner, Roger Fuhrman, Wendell Gilgert, Colin Gillin, Christian Hagen, Debbie Hollen, Brian Kernohan, Gina LaRocco, Jim Martin, Chris McKay, Steve Mealey, Charles Meslow, Holly Michael, Sara O'Brien, Bill Otani, Carol Schuler, Robyn Thorson, Robert Trost, Sara Vickerman

Pennsylvania
Douglas Austen, Calvin DuBrock, Dennis Fredericks, Jim Greer, Nick Hoffman, Joseph Hovis, David McNaughton, Gary San Julian, Dan Savercool, Michelle Tamez, John Taucher, Steve Williams

Quebec
Raymond Sarrazin

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Robert Abernethy, Laurel Barnhill, Carl Brown, Donnie Buckland, Billy Dukes, John Frampton, Mark Hatfield, David A. Hogue, James Earl Kennamer, Joel Pedersen, Gary Peters, Heber Pittman, Yvonne Plemmons, Tammy Sapp, Ted Schenck, Scott Vance

South Dakota
John Cooper, Pete Gober, Doug Hansen, Emmett Keyser, Tom Kirschenmann, Tony Leif, John Morgenstern, Cheryl Schmidt, Jeff Vonk

Saskatchewan
Dave Kostersky

Tennessee
Paul Ayers, Ken Babcock, Keith Belli, Tom Darden, Tony Dolle, Bob Ford, Dale Humburg, Gary Myers, Greg Wathen, Alan Wentz, Scott Yaich

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Ed Arnett, John Beall, Vernon Bevill, Kathy Boydston, Timothy Breen, Kirby Brown, Linda Campbell, Charles DeCurtis, Nina Fascione, Daniel Friese, James Giocomo, Wendy Gordon, Chuck Kowaleski, Roel Lopez, Jim Lopp, Jacob McCumber, Ross Melinchuk, Nancy Mitton, David Morrison, Kevin Porteck, Robin Riechers, Jay Roberson, Rosie Roegner, Gary Saul, Carter Smith, Matt Wagner, Dave Waldien, Ben Wallace, Clay Ware, Sarah Weber, Neal Wilkins, Clayton Wolf

Utah
Nicholas Brown, Danielle Chi, Alan Clark, Harv Forsgren, Nicole Frey, Lori McCullough, Miles Moretti

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Morris Aguilar, Laurie Allen, Lianne Ball, Lowell Ballard, Steve Barton, Terry Bashore, Celia Bassols, T Douglas Beard, Sara Bell, Robert Bendick, Robert Blohm, Peter Boice, Hannibal Bolton, Patti Bright, Bob Byrne, Leslie Catherwood, Shannon Cauley, Andrea Cerwinske, Mark Chase, Tammy Conkle, Maricela Constantino, Jorge Coppen, Oswaldo Cuevas, Joe Daigneau, Alison Dalsimer, Jeffrey DeBerry, Bruce N. Decker, Donald Dennerline, Patricia Doerr, Robert Doudrick, Mark Duda, Robert W. Duncan, Chris Eberly, David Eisenhauer, Robert Ellis, Erica Evans, George Fenwick, Erika Folk, Derrick Golla, Lew Gorman III, Sharon Gross, Susan Haseltine, Steven Hilburger, Douglas L. Hobbs, Stephanie Hussey, Douglas Inkley, Daniel James, Michael Johnson, Joyce Johnson, Rex Johnson, Kenneth Bruce Jones, Alicia King, Mary Klein, James Kurth, Johanna Laderman, Kris LaMontagne, Jane Mallory, Marcia Maslonek, Seth Mott, Gary Mowad, Steve Moyer, Laura Norcutt, Robin O'Malley, Andrea Ostroff, David Pashley, Frank Peterson, Christy Plumer, Susan Recce, Zachary Reichold, J.R. Robbins, Gordon Robertson, Kayne Robinson, Dan Sakura, Glen Salmon, Robin Schrock, Melissa Simpson, Robert Solomon, Joe Starinchak, Dave Stout, Ben Swecker, John Thompson, Chris Tollefson, Monica Tomosy, Dave Walker, George Wallace, Richard Weatherford, Kevin Whalen, David Whitehurst, Byron K. Williams, James Woehr, Thomas Wray II, Michael Wright

Vermont
Tom Decker, Mary Beth Deller, Rob Hoelscher, Eric Nuse, Scot Williamson

Washington
Trevor Anderson, Douglas Boyce, Dave Brittell, Hana Butler, Olga Camarena, James Chu, Leslie Dierauf, Valerie Elliott, Bob Everitt, Gerald Johnson, Don Larsen, Amanda Phillips, Kevin Powers, Carey Smith, Jonathan Wald

Wisconsin
Susanne Adams, Tim Andryk, Tim Asplund, Ellen Barth, Bill Bartush, Jasmine Batten, David Beckmann, Tara Bergeson, Owen Boyle, Greg Breese, Christine Bunck, Samuel Burton, Will Christianson, James Christopoulos, David Clausen, Kent P. Connaughton, Erin Crain, Scott Craven, Alan Crossley, John Curnutt, Dan Dessecker, Dan Eklund, Jonathan Ela, Becky Ewing, Andy Fayram, Kate Fitzgerald, Mike Foy, Edward Frank, Matthew Frank, Ron Gatti, Brian Glenzinski, Dan Gonnering, Heather Gottschalk, Robert Hansis, Tom Hauge, Jen Haverty, Brian Heeringa, Jeremy Holtz, Scott Hull, Chris Jennelle, Deborah Johnson, Dan Jones, Kelly Kearns, Michele Kille, Steve Kuennen, Julie Langenberg, Erin Larson, Olivia LeDee, Logan Lee, Ricky Lien, Tim Lizotte, Eric Lobner, Scott Loomans, Davin Lopez, Maggie Madden, Butch Marita, Karl Martin, Dave Matheys, Thomas Matthiae, Mike Meyer, Steve Miller, Dianne Moller, Paul L. Momper, Kerryn Morrison, Ben Mott, Nicole Munkwitz, John Nielsen, Rebecca Osborne, Laurie Osterndorf, Andy Paulios, John Pohlman, Jeff Pritzl, Chuck Quirmbach, Randy Rabideaux, Dave Redell, Holly Robertson, John Rothlisberger, Tami Ryan, Dave Sample, Carroll Schaal, Michelle Scheuermann, Nick Schmal, Rebecca Schroeder, Jan Schultz, Al Shea, Harv Skjerven, Jonathan Sleeman, Paul Smith, Michael Staggs, Randy Stark, Nicole Staskowski, Jason Suckow, Jack Sullivan, Wayne Thogmartin, Christine Thomas, Vanessa Thompson, Craig Thompson, Ollie Torgerson, Steve Ugoretz, Kent Van Horn, Bill Vander Zouwen, Jack Waide, Bob Wakeman, Keith Warnke, Norm Weiland, Tim Weiss, Quinn Williams, Michele Windsor, Barbara Wolf, Leonard Wurman

West Virginia
Janet Ady, Daniel Arling, Donna Brewer, John Edwards, Dwight Guynn, Sally Guynn, Georgia Jeppesen, Paul Johansen, Regina Main, Jim McCormick, Steven Niethamer, Cynthia Sandeno, Kurt Simon, Jay Slack, Clyde Thompson, Jack Tribble

Wyoming
Steven Belinda, John Emmerich, Steve K Ferrell, Paul Hansen, Robert Hanson, Brian Julian, Brian Kelly, John Kennedy, Larry Kruckenberg, Doug Miyamoto, Robert Model, Bill Rudd, Mike Smith, Rollin Sparrowe, Dale Strickland, Neil Thagard, Gray Thornton

Unrecorded

Roger Applegate, Umberto Berlanga, Don Blakley, Pete Blancher, Susan Bonfield, William Coleman, Nada Culver, Noel Cutright, Craig Czarnecki, Alex Daue, Robert Davis, Jr., Bob Decker, Jan Dizard, Andrew Dobson, Rod Dossey, Tom Fry, Kevin Fuller, Jeff Gronauer, Ann Hayes-Sutton, Greg Hendricks, Blake Henning, Kevin Hisey, Gabrielle Horner, Chase Huntley, Eduardo Inigo Elias, Adam Janke, Garrett Johnson, Judith Kennedy, Joe Kiesecker, Sarah Lynch, Craig Machtans, Noe Marymor, Curt Meine, Ralph Morgenweck, Tim O'Brien, Krishna Pacifici, J. Craig Potter, Jill Reilly-Hauck, Curtis Rollman, Gary Roloff, Ken Rosenberg, Jon Sadowski, Safiya Samman, Eduardo Santana, Eric Schwaab, Mark Storzer, Derek Strohl, Hilary Swain, Genevieve Thompson, Todd Tisler, Jordan Vana, Rosa Ma. Vidal, John Warner, Allison Welde, Gary Zimmer