

Our Nation's Wildlife Habitats

completing an integrated system for conserving their
values and benefits in a changing world

*A Synthesis of Research Findings
and Recommendations by the*



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The Wildlife Habitat Policy Research Program (WHPRP) has been working since 2006 to improve information and tools for accelerating wildlife habitat conservation in the United States in order to complete a wildlife habitat system for the nation. The WHPRP Program Committee has produced a report that presents its recommendations for completing such a system. These recommendations are supported by four years of focused research designed to define the system's scope and scale as well as challenges to completing it. The report includes specific findings from WHPRP-sponsored research and conferences and also reflects the Committee's judgments about the significance of the research results for wildlife conservation efforts. The full report is available online at: <WHPRP.org>. This statement summarizes its principal recommendations.

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Executive Summary

America is blessed with an abundance of public and private lands and waters that provide important fish and wildlife habitat and a host of diverse and valuable services to all the people of our nation. These resources are at greater risk today than ever before in our history.

The survival of one-third of the wildlife species in the United States is threatened by loss of wildlife habitat, climate change, environmental pollution, and encroachment of invasive species. Habitat loss is by far the greatest of these threats.

The Wildlife Habitat Policy Research Program (“the Program”) has been working since 2006 to improve information and tools for accelerating the conservation of wildlife habitat in the United States in order to complete a wildlife habitat system for the nation.

This report presents recommendations from the 12-member Program Committee for creating a wildlife habitat system for the nation. The recommendations are supported by four years of focused research designed to define the scope, scale, and challenges to completing a system. The report includes not only specific findings from Program-sponsored research and conferences, but also reflects the Committee’s judgments about the significance of the research results for wildlife conservation efforts

An Affordable Investment

Habitat conservation is a critically important investment that our nation can afford. The Program’s preliminary findings suggest that roughly \$12 billion annually is sufficient to build a strong habitat system for the nation and that the benefits will significantly exceed that amount.

Approximately \$9.3 billion annually is already being spent on a broad land-conservation agenda by federal, state, tribal, and local governments and private organizations. A significant part of this investment provides benefits to wildlife habitat, but more could be targeted to conserve habitat in concert with other land-protection goals.

Conserving an additional 218 million acres – or 12% of the total landscape of the continental United States – would protect all of the priority terrestrial habitat areas identified in State Wildlife Action Plans (SWAPs) for the 48 contiguous states.

Much of what is required is being spent. Existing public and private conservation programs are spending much of the amount that will be required to protect and restore all the priority lands that the states have identified. Conservation spending through existing federal and state programs from 1992-2001 – as well as current federal spending on mitigation – adds up to approximately \$7.3 billion annually. These figures do not include conservation investments by the land trust community or local governments; the Trust for Public Land reports \$21.4 billion was approved for spending by local governments from 1999 through 2009.

Scientific methods and data exist to generate reasonable cost estimates for various conservation strategies for individual landscapes. Estimates indicate that completing a wildlife habitat system for the nation is within the range of investments in other significant infrastructure projects such as the National Highway System.

Benefits to Our Nation's People

We should all be deeply concerned about the decline of our nation's wildlife habitats. They support biodiversity, slow climate change, provide clean water, prevent floods, enrich soil, and provide many recreational, aesthetic, and spiritual benefits.

The value of natural resources is often measured by calculating the market value of products that are extracted and sold – timber, for example. Nevertheless, we know that the true economic value of natural resources is more than their current market value. Researchers are attempting to calculate the benefits of wildlife habitat for our quality of life by determining the monetary value of the full spectrum of products and services that they provide.

Landscape-Scale Conservation

Wildlife habitat protection must occur at the landscape scale. Although our nation has made important strides in fish and wildlife conservation over the past century, it has been common to manage only for single species and to act only when species became threatened with extinction. This approach is inadequate for the task of conserving the full diversity of life.

For example, climate change is already disrupting natural systems in many ways, including coastal wetland flooding caused by rising sea levels and loss of fresh-water resources resulting from increasingly intense droughts and declining snowpacks. A landscape-scale conservation perspective coupled with a more sophisticated analysis of where to conserve land and new management strategies for adaptation over time will help address the impacts of climate change and other major threats to our wildlife habitat.

The next step in conservation planning is to explicitly link priority species with habitats in a landscape-scale ecological framework in order to understand where to get the best return from our conservation investments. One goal of the U.S. Fish and Wildlife Service (USFWS) Landscape Conservation Cooperatives (LCCs) is to increase information sharing that will promote conservation planning at the landscape scale. Initiatives such as America's Great Outdoors are working to define the lands that are needed for wildlife and people, another dimension to planning and implementing habitat conservation.

Available Tools

Many potentially effective tools are available to respond to climate change, land conversion, energy development, and other threats to wildlife habitat.

State planners can build on past and current conservation efforts to identify threatened priority habitat areas for future conservation investments. Our existing land conservation system can be enhanced through easements, landowner agreements, market-based transactions, land purchases, and other innovations. Maps of priority areas can catalyze actions to conserve important habitats and help avoid, minimize, and mitigate habitat conversion and fragmentation.

A blend of compensatory mitigation and other regulatory approaches will probably be necessary. Mitigation programs are a well-developed approach to addressing impacts of infrastructure and other development activities on natural habitats. Mitigation can include avoiding the impacts of an action – such as the building of roads, bridges, energy infrastructure – or minimizing, reducing, or eliminating the impact and compensating by replacing or providing substitute resources

The public sector can utilize public finance mechanisms such as bond acts, transfer taxes, development fees, and property taxes in addition to legislative appropriations. Private-sector support can come from philanthropic institutions, landowners, and private investment entities that include conservation in their for-profit business model. Regulatory approaches can support conservation through land-use restrictions, mitigation requirements, natural hazard regulations, and natural resource damage settlements.

Expanded Collaboration

We need a sufficient and comprehensive connected habitat network of lands and waters extending from the inner city to the wilderness, as well as the resources to manage it. This will require expanded collaboration and partnerships across landscapes and jurisdictions.

We are already investing considerable resources in land and habitat conservation through various state, federal, private, and tribal programs, each with its own program goals and priorities. However, the challenge is bigger than any single agency or organization – it must engage the energy, resources, and commitment of people from public and private sectors on many scales.

An effective wildlife habitat system for the nation must be based on an approach to protecting, managing, and restoring habitats that is not overseen by a single entity but includes leadership from both the public and private sectors. It will require collaboration across many disciplines, agencies, and land ownerships. It must acquire and protect sufficient habitat to support abundant and well-distributed fish and wildlife populations. As climate change accelerates, ecological communities are disassembling and species are shifting their ranges, making the need for restoration and management increasingly pressing.

Government agencies charged with managing natural resources often fail to collaborate with available partners and to leverage new fiscal and technical resources. Agencies can leverage more resources to support habitat conservation by considering non-traditional partners and sources of funds. For example, at least \$3.8 billion is spent annually on habitat restoration through compensatory mitigation under the Clean Water Act and other environmental laws. Natural hazard mitigation projects also provide significant funding, as could mitigation requirements related to the impacts of energy development.

Completing a wildlife habitat system for the nation will require work by the broader conservation community, not just fish and wildlife agencies. The first generation of SWAPs, produced by the nation's leading wildlife experts, demonstrated that conservation partnerships and collaborations are as complex as the ecosystems that support fish and wildlife. In the future, conservation partners will not only be part of conservation delivery, but they will also be integral to conservation planning.

I. Program Vision and Approach

The Wildlife Habitat Policy Research Program (WHPRP) was established to examine key policy questions related to conserving fish and wildlife habitat with a view toward accelerating the process of completing a wildlife habitat system for the nation.

Completing a wildlife habitat system for the nation is a major, long-term mission that generates many policy-relevant research questions across a number of disciplines. For example:

- How much land must be protected to complete a wildlife habitat system for the nation?
- What will it cost to achieve the desired level of protection and what are the most efficient methods for achieving it?
- What ecosystem services such as water purification, carbon sequestration, and flood control do protected lands provide, and what is the monetary value of those services?
- How will climate change affect conservation activities? How can programs adapt to change?
- How can State Wildlife Action Plans (SWAPs) integrate their efforts with other programs whose mission and funding resources align with habitat conservation?

The primary mission of the Wildlife Habitat Policy Research Program (the “Program”) is to improve information and tools to accelerate conservation of wildlife habitat in the United States. This includes implementing State Wildlife Action Plans and completing a wildlife habitat system for the nation.

The Program is funded by a grant from the Doris Duke Charitable Foundation to the National Council for Science and the Environment to design and conduct the Program. The Council is an independent, non-profit organization dedicated to improving the scientific basis for environmental decision-making.

The Program used competitively awarded grants to sponsor innovative projects by the best qualified investigators in academia, government, business, and nonprofit institutions across the nation. Proposals were reviewed by external, independent panels of experts and evaluated for practical value as well as technical quality.

The Program is planned and overseen by a Program Committee of twelve leaders from diverse backgrounds and affiliations including conservation organizations, state and federal agencies, private business, and academia (see page 2). The Program Committee has identified barriers to effective implementation of a wildlife habitat system for the nation that include:

- gaps in the understanding of scientific and policy questions related to habitat conservation
- insufficient transformation of research results into usable information
- lack of tools to measure and evaluate progress
- inadequate communications across sectors within the conservation community.

The Committee meets twice yearly to review program objectives and the projects that address those objectives. They also monitor progress and assist with communication and outreach activities. The Program has issued three sets of requests for proposals and commissioned 16 projects during its initial four years. The final two years of the Program builds on these results to synthesize, demonstrate, and communicate

the significance of the work to a broad range of wildlife conservation practitioners, managers, and policy makers.

Challenges to Completing a Wildlife Habitat System for the Nation

Issues:	Costs	Benefits	Effectiveness	Efficiency	Equity
Questions:	How much land needs to be in the conservation system and what will it cost?	What other ecosystem services does society derive from land conserved for wildlife?	How much funding is available across sectors for completing the habitat conservation system?	What are the relative financial efficiencies of deeds, easements, and stewardship agreements as instruments of habitat conservation?	What portion of the conservation bill is being paid by the public and how much by private entities?
	How are these costs changing with time?	What is the monetary value of those services?	What is the taxonomy of conservation incentives and what is their relative effectiveness?	What are the essential elements of a market for ecosystem services?	What is the relative public support for various instruments of land conservation?

The goals of this synthesis report are to:

- enhance awareness of the importance of completing a wildlife habitat system for the nation
- define the scope and scale of completing such a system
- support defining, valuing, and financing such a system.

In addition to reflecting the findings of the WHPRP-sponsored projects, the material in this report was derived from Program Committee discussions with researchers and among themselves regarding interpretations of the significance of the research results.

II. Program Results

Many citations throughout this report reference the WHPRP project codes and principal investigators' last names such as: (1B. Joyce). A complete list of the Program's projects is in Appendix I. The full technical reports, non-technical overviews of each project, and supporting materials can be found at our website: www.WHPRP.org

A. An Affordable Investment

1. A Bundle of Values

Public opinion research supports the premise that wildlife is an important element in our quality of life. It is an ancient and widespread human practice to conserve and manage natural lands to ensure that they produce fish, wildlife, and plants, and that practice continues in our own time. For example, from 1999 through 2009, voters across the country authorized slightly more than \$38 billion to support state and local land-conservation programs (Landvote.org). While voters are generally supportive of conserving undeveloped open space and wildlife habitat, they may be less aware of the valuable ecosystem services that wildlife habitat provides for all of our nation's people (Teaming.com). Creating a broader understanding of the value of these services, coupled with a better accounting of the costs and benefits of wildlife habitat, will support increased investment in habitat conservation (The Nature Conservancy, 2009).

We need reliable estimates of investment costs to develop and implement more effective public policies and actions for wildlife habitat conservation. The need to value the benefits associated with habitat conservation is as important as providing an estimate of the cost of conserving wildlife habitat. Defining the economic value of the ecosystem services provided by land conservation – including wildlife habitat – will help us assess the opportunity costs of protecting various parcels of land more accurately, resulting in more efficient investments. Depicting the full range of significant benefits for many diverse interests will broaden support for conservation (1G. Urban).

Ecosystem services provided by wildlife habitat and other natural lands contribute to healthy and secure lives for all of our nation's people. These services include:

- protecting watersheds that provide clean water for drinking and other human uses
- preventing floods by holding back the flow of stormwater
- enriching soil by recycling nutrients
- providing recreational, aesthetic, and spiritual benefits.
- supporting biodiversity, the variety of plant and animal species that is essential to the health of natural biological systems and human communities
- slowing climate change by sequestering (storing) carbon from atmospheric carbon dioxide absorbed by trees and plants

Economic values can be assigned to these benefits based on their respective contributions to people's well-being. These values should be taken into account when considering the costs and benefits of converting natural lands to other uses.

As land development and other forms of land conversion, climate change, and other threats increasingly affect areas that are important for wildlife and humans, planners and policy makers need better ways to assess the tradeoffs for investing in wildlife habitat. As our climate continues to change, it will be particularly important for us to fully recognize the uses and values of wildlife habitat. Although major gaps remain in our knowledge of how to calculate the values, costs, and benefits of completing a wildlife habitat system for the nation, WHPRP-sponsored research has provided us with valuable new estimates of costs and benefits, more rigorous analytical tools, and a path to accelerated conservation.

2. The Bottom Line

Developing a reliable cost estimate for completing a wildlife habitat system for the nation is a key to providing better understanding of the magnitude of conservation investment needed.

Primary responsibility for wildlife management in the United States traditionally has rested with individual states. To be eligible to receive funds from the State and Tribal Wildlife Grants Program created by Congress in 2000, every U.S. state and territory was required to develop a state wildlife action plan (SWAP). These plans identified priority terrestrial habitat areas in each state.

Conserving an additional 218 million acres – or 12% of the total landscape of the continental United States – would protect all the priority terrestrial habitat areas that the SWAPs identified in the 48 contiguous states. Comparable information was not available for Alaska and Hawaii (1F. Casey). Although conserving this acreage may not help aquatic species and may be difficult to complete in some states, it would be a giant step forward in developing a working national habitat system.

Cost estimates show that we can protect these lands by investing approximately \$218 to \$927 billion over 30 years. Using an intermediate value of \$350 billion, we should be investing \$12 billion per year now in order to complete the system in 30 years (1F. Casey). Although these are large sums by conservation standards, they are modest by comparison with other large-scale infrastructure investments made annually – less than half of what we invest each year in either highways, water supplies, or sewer systems.

Annual State and Local Infrastructure Expenditures, 2005-2006	
Highways	\$135 billion
Airport transportation	\$18 billion
Sewerage	\$39 billion
Water supply	\$47 billion
Mass transit	\$46 billion
Solid waste management	\$22 billion
Electric power	\$66 billion
<i>Wildlife habitat</i>	<i>\$12 billion (recommended)</i>

(Source: [Census.gov](http://www.census.gov))

3. Current Spending

Existing public and private land and water conservation programs are spending close to the amount required to complete a wildlife habitat system for the nation, although it isn't clear how much of this funding is being spent on state-identified priority wildlife habitat.

An examination of federal and state land and water conservation spending from 1992-2001 – as well as current federal spending on mitigation – shows approximately \$7.3 billion being spent annually, with an unknown portion of that total dedicated to wildlife habitat (Lerner et.al. 2007). These figures do not include conservation investments by the land trust community or local governments. According to the Trust for Public Land, local governments spent \$21.4 billion from 1999 through 2009, an additional annual average of \$2 billion (Landvote.org), although not all funding from these measures has been spent.

Even if all current expenditures went to habitat priorities, a gap would remain between the amount being spent now and the amount needed to complete a wildlife habitat system. We need more research on expenditures to quantify this gap. **Providing the necessary funding will require strategically directing existing funding to the highest priority lands and obtaining additional funds to complete the job.**

Refining this estimate of the cost of a wildlife habitat system for the nation will be valuable, but more useful estimates may come out of systematizing how states and regions collect land acquisition data to get more accuracy at smaller scales. State programs need to work more at collecting data for – and guiding investment by – non-state private programs. We know very little about these programs (2B. Casey).

The Doris Duke Charitable Foundation and other public and private partners have funded the development of the Conservation Registry (Conservationregistry.org), designed to track and map conservation actions across the landscape and to synthesize information from multiple sources. Its widespread adoption by government agencies and other organizations would simplify the process of collecting and analyzing this information and make it more transparent. Other databases are being developed by The Trust for Public Land (ConservationAlmanac.org) and the partnership working on the National Conservation Easement Database (<http://www.natureserve.org/projects/pdfs/ncedFlier.pdf>).

4. Economic Benefits

We do not yet have a robust estimate of the benefits of a wildlife habitat system for the nation. What is the collective value of all the products and services that nature provides? Is it worth it to invest billions to conserve wildlife habitat? New tools for measuring the value of ecosystem services are expected to provide a more accurate understanding of benefits of wildlife habitat and the magnitude of their value (1H. Kroeger).

A first approximation of market and non-market benefits of protecting wildlife habitat in a set of case study areas in five states shows the projected benefits of such a system far outweigh the projected costs. With a combined total undeveloped area of 3.68 million acres, these study areas provide annual economic benefits estimated at \$283-\$572 million – a mean value of between \$77 and \$155 per acre per year. Extrapolating these values for the 218 million acres of priority lands identified in all the SWAPs produces a rough annual estimate of benefit value between \$16 billion and \$34 billion (1H. Kroeger).

These figures include analyses of:

- property value benefits that accrue to lands adjacent to protected areas
- wetlands value for stormwater runoff, flood control, and water quality protection
- recreational use and values for hunting, fishing, and wildlife viewing
- timber and commercial fishing revenues (where applicable)
- the value of providing habitat for endangered and threatened species.

We know the economic value of natural systems is more than what the market currently values. Ecosystem services such as flood prevention, pure water, and carbon sequestration are benefits of protected habitat lands. Market-based programs for wetlands, water quality, and carbon reduction are emerging, but ecosystem services generally are not bought and sold in the market, so their value is often underestimated or completely ignored. As our understanding of the value of ecosystem services improves, we can make better decisions about which lands should be saved for the services they provide and which ones can be used for other purposes.

5. Measuring Benefits

As habitats decline in the face of threats such as climate change and urban development and limited resources are available for wildlife habitat protection, strategic investment will be required. Such investing will demand a better understanding of local benefits for individual project sites – benefits that we currently are not able to quantify accurately (1G. Urban).

Local decision-makers need practical tools to estimate the value of benefits of habitat conservation that do not have market value in the conventional sense. The value of ecosystem services varies with location, so despite the fact that many studies exist, most local land-use decision makers cannot easily apply the results of those studies to their own projects.

WHPRP-sponsored researchers have developed a tool for use on a project-based scale across various locations that is especially useful to local decision makers (1H. Kroeger). The *Habitat Benefits Estimation Toolkit* is a set of spreadsheet-based valuation models, tables, and databases designed for practical application by land-use and wildlife planners. It directs users to readily available data that allow them to estimate the economic impact of wildlife-associated recreation in their jurisdiction. The toolkit is meant to help justify expenditures on habitat lands and prioritize protection sites by quantifying the total economic value of a project site.

Valuation Models in the WHPRP-sponsored Habitat Benefits Estimation Toolkit

- *Open Space Property Value Premium* model
- *Activity Day Value* models for hunting, fishing and wildlife viewing
- *Habitat Value* or *Habitat Improvement Value* models for terrestrial and aquatic habitats and wetlands
- *Threatened, Endangered and Rare Species Value* model, and
- *Salmon Value* models (where applicable)

The researchers evaluated the toolkit by studying two services: scenic amenity values added to adjacent properties when land is conserved and recreational values of habitat lands for direct uses such as fishing, hunting, and wildlife viewing. Their findings confirm that open space enhances property values for neighboring land. While all open space generates these values, they are highest for forested and natural lands and lowest for agricultural lands. The study also found that increases in conservation acreage generally lead to increases in wildlife-associated recreation activities.

Estimated Annual Value of Benefits Provided by Five Study Areas (million 2004\$)						
BENEFIT	Location	Florida	Nebraska	New Mexico	Oregon	Maine
	Ecosystem Type	Wetlands Lowlands (825m ²)	Riparian (858m ²)	Forest (4900m ²)	Coastal Estuary (29m ²)	Upland Wetland (60m ²)
Direct Uses:						
	Timber extraction			3.2		0.07*
	Non-timber products			3.7		
	Grazing				0.28	
	Commercial fishing				0.9	
	Recreation	2.6*	2.3-3.0	7.0	1.0-2.3*	0.25*
	Research and education					
	Property value premiums	6.5	0.5	5.3	.42	2.0*
Ecosystem Services:						
	Water supply	130-285				2.0
	Water quality					
	Species habitat					
	Biodiversity maintenance					
	Temperature modulation					
	Crop pollination					
	Carbon sequestration	5.1-21.2	0.6-3.6	22-120	0.2-0.6	0.2-1.3
	Air quality					
	Total Value/Year: (millions 2004\$)	145-315	24-41	106-205	3-5	5-6

*incomplete estimate

Source: Kroeger, T. 2008. An Assessment of the Economic Benefits Provided by Conservation Lands, Washington, DC: Defenders of Wildlife.

B. Accelerating Habitat Conservation

Given that habitat loss is by far the greatest threat to wildlife conservation and new research shows us the costs and benefits of completing a wildlife habitat system for the nation, what can we do to accelerate habitat conservation?

1. Closing the Gap

More strategic spending can close the gap by \$3 billion. Funds are available for implementing wildlife action plans if wildlife managers share their knowledge and data with those who are setting goals and making plans for other conservation programs – such as well-funded mitigation programs – and help them identify sites that are appropriate for wildlife habitat conservation (2B. Casey).

Investing in projects that align wildlife interests with other conservation needs and programs can leverage resources more effectively. However, we have failed to take full advantage of these opportunities. For

example, incorporating habitat priorities into the watershed approach being used by federal agencies such as the Environmental Protection Agency will harness investments made to meet compensatory mitigation requirements to take better advantage of mitigation and habitat banking policy. Research completed in this program can help state wildlife program managers better understand the opportunities for leveraging their wildlife action plans.

Other programs such as the U.S. Farm Bill also provide partnership and leveraging opportunities. The 2008 Farm Bill provides approximately \$23 billion over five years to fund conservation programs – an increase of more than \$4 billion for natural resource protection. The bill also provides specific authority to address issues raised by the SWAPs. States receive conservation program allocations ranging from \$10 million to \$100 million annually.

Link Habitat Protection with Mitigation Projects

Mitigation programs are a well-developed approach to addressing impacts of infrastructure and other development activities on natural habitats. Mitigation can include avoiding the impacts of an action – such as the building of roads, bridges, or energy infrastructure – or minimizing, reducing, or eliminating the impact and compensating by replacing or providing substitute resources. Mitigation programs provide another opportunity for state fish and wildlife agencies to align their wildlife interests (3B. Wilkinson).

A blend of compensatory mitigation and other regulatory approaches could be very useful in conserving wildlife habitat. (3B. Wilkinson). Widespread environmental impacts of land development and other land conversion practices have significant effects on habitat. Although many impacts go unmeasured, five key federal programs (Clean Water Act, Endangered Species Act §10, federal natural resource damage programs, the Federal Power Act, and the Northwest Power Act) require compensation – or offsets – to development impacts on natural resources. The Environmental Law Institute estimated that private and public expenditures for compensation under these programs total approximately \$3.8 billion annually (Environmental Law Institute, 2007).

About \$2.9 billion of this spending is generated through the compensatory mitigation requirements of Section 404 of the Clean Water Act administered by the Corps of Engineers. The Corps reports that from 2000 to 2006 the annual amount of wetland acreage permitted for impacts ranged from 18,900 to 24,650 acres, for an average of 20,620 acres a year. Over the same time period, the amount of compensation required varied between 38,727 and 57,820 acres per year and averaged about 47,384 acres per year.

Chart 1: Estimated Annual Compensatory Mitigation Costs Expended or Committed Under Major Federal Regulatory Programs

<i>Regulatory Program</i>	<i>Cost Estimate (in millions)</i>
Clean Water Act Section 404	\$2,947
Endangered Species Act Section 10	\$370
Federal Natural Resource Damage Programs	\$87
Federal Power Act	\$210
Northwest Power Act	\$207
Total:	\$3,822

Source: Environmental Law Institute. October 2007. *Mitigation of Impacts to Fish and Wildlife Habitat: Estimating Costs and Identifying Opportunities*. Washington, DC.

As the coverage of mitigation compensation projects reaches 50,000 acres annually, significant opportunities exist for improving current mitigation programs to help them conserve wildlife habitat more effectively.

In spite of the current economic recession, extensive investment in infrastructure is expected over the next decade and beyond. Anticipated impacts of population growth, transportation development, energy development and transmission, and climate change and sea-level rise are expected to demand extensive investments over the next ten years. In the energy sector, for example, in order to meet low-carbon electricity and biofuel production requirements, as much as one-fifth of the nation's land area may be needed for energy production and transmission facilities. These trends will have significant impacts on natural systems, including habitat fragmentation and loss of ecosystem function. A broader set of mitigation strategies will be needed to compensate (3B. Wilkinson).

SWAPs could help frame this new generation of mitigation by moving programs away from fragmented approaches, which often result in a patchwork of isolated and disconnected habitats, toward a landscape approach that integrates goals for land conservation. A more comprehensive approach to mitigation informed and guided by SWAPs and other federally recognized conservation plans will conserve natural landscapes and healthy watersheds more effectively than the current piecemeal approach.

Priority Habitats in Hazard-Prone Areas

SWAPs are implemented within a broader framework of federal, state, tribal, and local planning for biodiversity, land use, natural hazards, and coastal management that provides many opportunities for program integration and collaboration. One opportunity is in disaster mitigation planning. State and local governments are required to prepare hazard mitigation plans to receive federal disaster assistance. The plans must assess the risks posed by natural hazards, such as flooding and coastal storms, and a strategy to reduce the risks – including acquiring land or discouraging development in the most hazard-prone areas to reduce risks to people and property. These undeveloped lands can provide valuable wildlife habitat (2D. Salvesen).

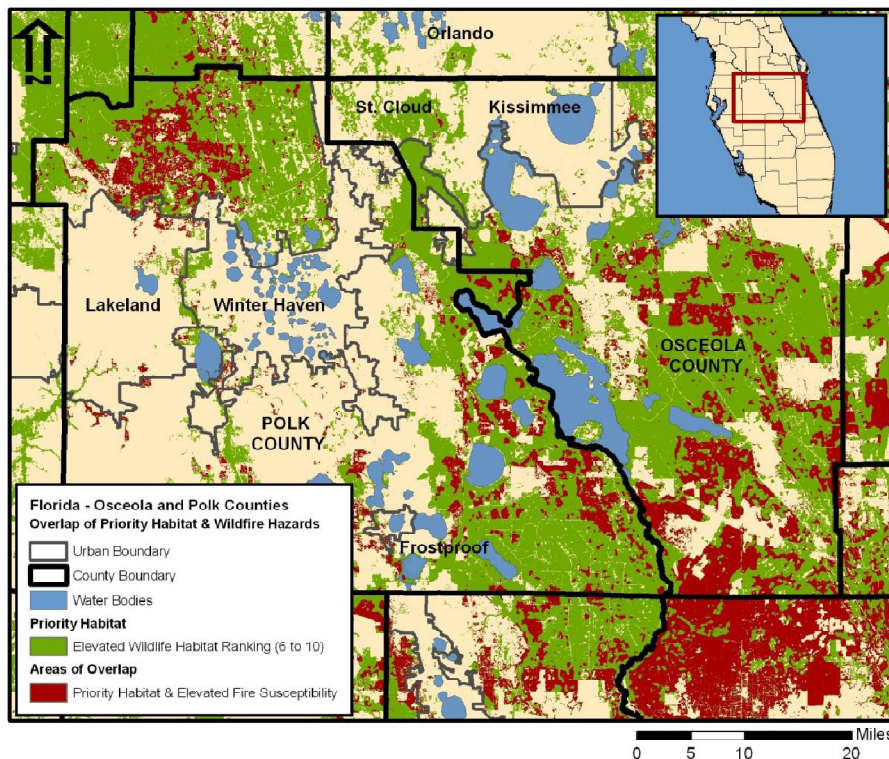
Flood control, for example, traditionally has relied on levees, dikes, dams, and other structural solutions. In recent years, the Army Corps of Engineers has also begun to use many non-structural approaches such as expanding floodways and natural habitats, creating floodwater storage basins, and developing floodplain-management initiatives that provide places for floodwaters to go. Since the long-term solution to minimizing risk to people and property consists of keeping flood-vulnerable development and uses out of the floodplain, there is a natural overlap of goals between flood-mitigation programs and habitat-protection programs.

Making the Most Out of Mitigation Programs

In using mitigation funds to further floodplain restoration and wildlife conservation goals, we recommend:

1. ensuring that mitigation programs provide meaningful wildlife habitat and sustained ecosystem services
2. developing clear guidelines for incentive programs that place emphasis on the restoration of priority habitats and natural floodplain functions to yield multiple benefits
3. increasing coordination among federal, state, tribal, and local agencies to help identify opportunities to leverage alternative sources of funding to meet multiple watershed restoration goals
4. increasing the capacity of local governments to identify sources of restoration funding and implement restoration activities in hazard-prone areas to meet both local planning/emergency management goals and regional wildlife conservation goals
5. encouraging landowner participation in mitigation and incentive programs.

(Source: 2D. Salvesen)



(Source: 2D. Salvesen: Habitat Conservation Opportunities in Natural Hazard Areas)

In three states that were studied – Florida, Washington, and Wisconsin – WHPRP researchers found considerable overlap between hazard areas and priority wildlife habitat. Nevertheless, when land-use and hazard-mitigation planners were interviewed in these states, the researchers generally found a lack of

awareness regarding SWAPs and some concern on the part of planners that their missions may not overlap (2D. Salvesen).

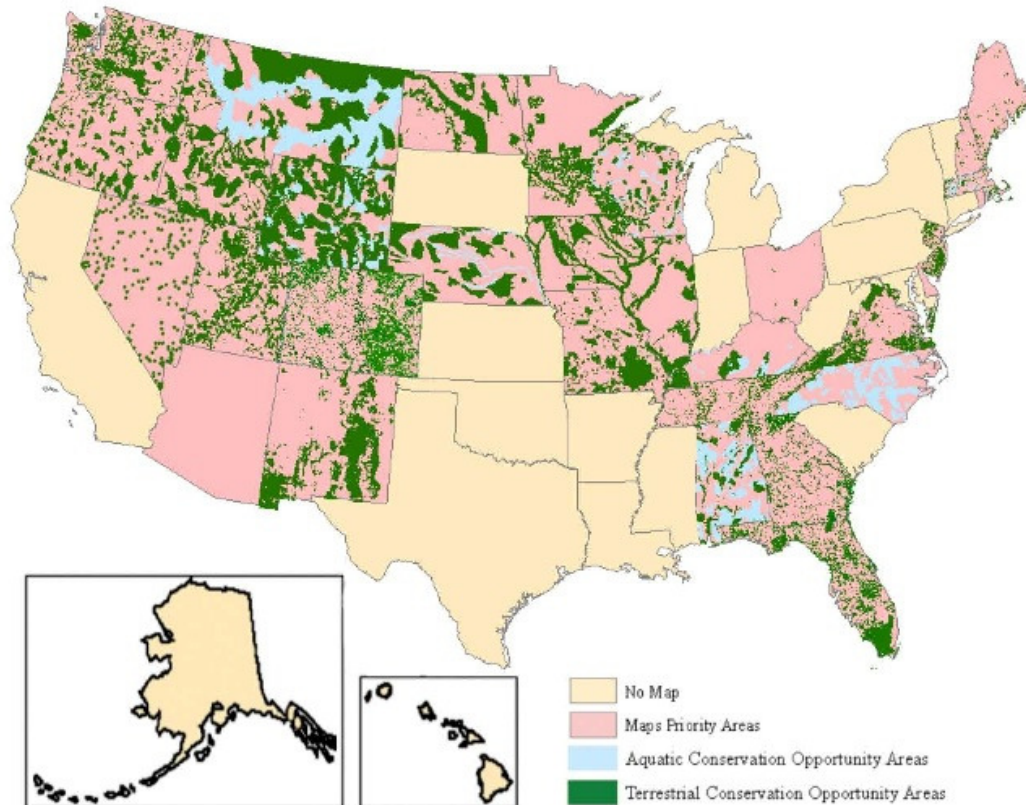
However, in some cases, even when hazard-mitigation plans made no explicit reference to habitat protection, planners often referenced and used wildlife plans and data in specific projects – especially if a relationship existed between agencies or individuals that allowed information to be easily exchanged. Connections between the two programs produced clear benefits for both.

2. Priorities Leverage Investment

States that set clear conservation priorities have been more effective in aligning conservation investments and coordinating diverse partners; SWAP priorities help other conservation partners link their work with state fish and wildlife agency efforts. One challenge to engaging partners is the sheer size of some SWAPs. In many cases, they are so large – more than 500 pages – that their size and organization limits their usefulness as strategic guidance documents. The emphasis on making the plans comprehensive has made it difficult for partners, such as local governments, to understand state priorities (1A. Davis).

Maps of priority areas are particularly effective in engaging partners; they are critical to understanding where to work and directing others about where not to develop. At least thirty states now have maps of priority geographies. All of the WHPRP researchers cited the value of maps and the limitations of their findings without them. Clear standards for data collection and mapping must be devised to track progress and integrate data across state borders (1A. Davis).

A slight increase in standardization of information and multi-state planning processes in the SWAPS when they are updated in the next planning cycle could allow regional and national assessments could be built from the state plans. This could be encouraged by creating incentives for greater coordination.



(Source: Doris Duke Charitable Foundation)

C. Management Strategies

Estimates by WHPRP-sponsored researchers (1F. Casey) show that it is likely to cost at least \$12 billion per year over 30 years to expand a wildlife habitat system for the nation to the point where it effectively addresses the needs of most species. Other researchers question whether 30 years is a short enough timeframe to protect all the habitat that must be conserved to defend some species from extinction and buffer some vulnerable areas against the impacts of global climate change (2C. Wilkinson).

The United States is expecting significant population growth by 2037, adding 100 million more people for a total of 400 million. Experts predict that almost two million new housing units will be built each year to meet growing residential demand (Nelson, Lang 2007). The pressure for residential development, conversion of agricultural land to other uses such as bio-fuels production, and energy development means some states may lose a high proportion of their priority habitat to development over the next 30 years.

Climate change will also affect our ability to effectively restore and manage habitat. Our capacity to implement existing wildlife goals is already limited by diminishing funds and smaller state agency staffs. All states will be required to update their SWAPs by 2015, and revisions are expected to reflect the accelerating impacts of climate change, as the original plans did not consider climate change when delineating

habitats. Developing and implementing new strategies that consider climate change will also involve new approaches. Wildlife adaptation may require conservation managers to use a habitat- or ecosystem-based approach and to consider adaptive management for dealing with the uncertainties of possible impacts. Species conservation efforts that focus on identifying and protecting habitats most likely to survive climate change will probably be better investments than those that focus on habitats that are likely to become unsuitable (Association of Fish and Wildlife Agencies, 2009).

The SWAPs provide us with a better assessment of the scope of action necessary for landscape-scale conservation. We also now have an estimate of how much it would cost to conserve each state's priority habitats for a wildlife habitat system for the nation – and the conservation deficit we will face if we do not complete a national system.

1. Landscape-Scale Habitat Protection

The complexity of the challenges to completing a wildlife habitat system for the nation suggests a new approach to protecting habitat based on thinking in terms of larger ecological regions, more specifically, landscape-scale conservation. In turn, this landscape-scale perspective must be coupled with a more sophisticated analysis of where to conserve land and new management strategies for adapting as issues such as land use and climate change continue to make an impact.

What is a landscape? In the context of this report, it can be defined as a heterogeneous geographic area composed of diverse interacting patches or ecosystems that can range from relatively natural systems such as forests, grasslands, and lakes to human-dominated environments such as farmland and cities. A landscape can be as large as a multi-state region or as small as a single watershed.

Why is a landscape-scale perspective critical to the concept of a wildlife habitat system for the nation? Planning at the landscape-scale planning stretches across political boundaries, allows large-scale natural processes and disturbances to occur, and promotes collaboration between the public and private sectors. As the human footprint on our nation's landscapes increases, the ability of wildlife to move from place to place is more restricted, natural habitat is lost, and the remaining habitat is subjected to fragmentation and degradation. These changes can lead to endangerment or extinction of species. One of the most effective strategies to slow the threats posed by habitat fragmentation is to work at the landscape level to protect crucial habitats by maintaining connectivity to allow wildlife to move among them.

The SWAPs are driving a new view of habitats on a larger scale and using that perspective to frame opportunities and engage partners. The process for developing each plan was critical to identifying the location and relative condition of crucial habitats. However, inconsistency among states in selecting conservation targets and methods for identifying and prioritizing habitats and addressing connectivity needs will make landscape planning across state boundaries a challenge.

2. Land Use Conversion Rates

Residential Development

All SWAPs show development and suburbanization as one of the greatest threats to accomplishing their goals. Time-sensitivity research suggests that some states will lose a high proportion of their priority habitat to development over the next 30 years. Other states, such as Montana, are not likely to lose as much (2C. Wilkinson).

Between 1980 and 2000, the footprint of urban development in the United States grew by 1.6% annually. A 2005 study found that over the next 15 years, the annual rate of increase in urban and suburban housing densities is expected to be 2.2%, while the annual rate of exurban development in areas beyond the cities and suburbs is expected to be 14.3% a year (Theobald 2005).

When the focal areas in six SWAPs were reviewed and overlaid with an analysis of residential development impact and habitat modification over time, the results showed a loss in all cases. The losses were at various time intervals (up to the year 2050) and ranged from 10 to 50%. In the Atlanta metropolitan area, for example, many habitat areas face high threats in the next ten years.

Researchers found that in three of six case-study states, more than 10% of the land in focal areas identified in the SWAPs probably will be converted to residential development over the next 10 to 30 years. Time-sensitivity analysis is helping us focus on those most threatened habitats to show where states should target their implementation efforts. The highest losses are expected in the next 10 to 30 years, and the threat of conversion is higher in metropolitan and urbanizing areas (2C. Wilkinson).

Biofuel Development

Overall, future practices should limit biofuel production on priority habitats, with previously converted fields being the best target for these projects. SWAPs can be used to help guide the location of biofuel production away from priority habitats.

Production of liquid biofuels, primarily corn-based ethanol, has increased significantly in the United States over the last decade. By 2022, U.S. biofuel production from all sources is expected to reach 36 billion gallons annually – approximately four times the amount produced in 2008. Such a surge in biofuels production will require converting large amounts of currently fallow and/or non-intensively managed land into feedstock production, and bio-energy development is likely to place heavy stress on wildlife habitat (2E. Fletcher).

WHPRP-sponsored researchers developed a national-level spatial model of feedstock production for meeting the 2022 goal of 36 billion gallons/year. They produced gross estimates of national land-cover types at risk of conversion into corn, switch grass, and southern pine plantations under these scenarios. Potential risks from increased biofuel production in critical habitat areas in four states (Florida, Georgia, North Dakota, and Iowa) were studied to look at ways to mitigate impacts on wildlife. Both national and state analyses indicate significant conversion risks for many habitat types due to the overall large footprint implied by biofuel production at projected 2022 production levels. In some cases, the researchers expect that land cover will not change, but the potential for changes in management of land uses with biofuels production may change in ways that could affect wildlife. For example, smaller diameter pine trees may be harvested for biofuels than for other uses, which could have net benefits for wildlife (2E. Fletcher).

The researchers recommend a suite of approaches to protect and enhance biodiversity on lands intended for biofuel feedstock production, including more work to examine impacts in each state on current crop production as well as habitat loss (2E. Fletcher). In addition, they suggest:

- promoting practices such as minimum tillage and reduced fertilization and pesticide use that minimize potential negative effects of biofuel production
- modifying and updating best management practices for silviculture to include bio-energy production needs, such as minimal construction of roads

- developing mandatory best-management practices for protecting sensitive areas such as wildlife corridors, riparian zones, and buffer strips, including measures to restrict the introduction of invasive and genetically modified species
- developing market-based incentives to enable landowners to undertake practices that enhance wildlife habitat, such as species mixtures and crop rotations, and retaining sufficient quantities of harvest residues.

3. Adapting to Climate Change

Climate change has great potential to alter the nation’s natural resources. Because primary responsibility for wildlife management in the United States rests with individual states, state agencies need spatially explicit information on the magnitude of projected climate change impacts on wildlife habitat and tenable options for responding (1B. Joyce).

The states’ efforts are supported by emerging knowledge about climate change and potential responses to its impacts. A new informal network of professionals is advancing this knowledge and the idea that adaptation strategies can mitigate the impacts of climate change by building resiliency into natural systems (2F. Kostyack). Many now believe that habitat conservation will not be effective unless climate change adaptation becomes the overarching framework for conservation and wildlife management planning. However, uncertainty about how the climate will change, and where and how it will affect wildlife, has impeded development of adaptation strategies for wildlife habitat.

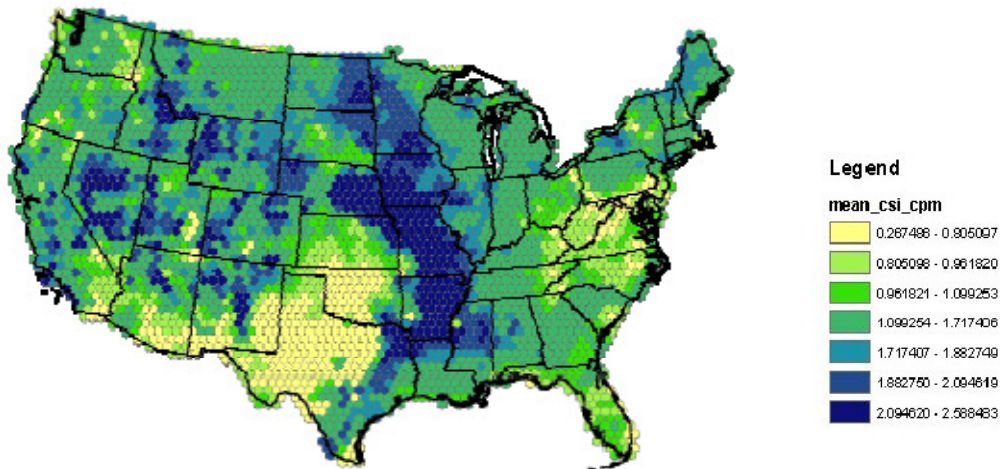
Indexing the Risk

To help us understand where climate change would have the greatest impacts, WHPRP-sponsored researchers developed a climate stress index to evaluate habitat-specific risk from climate change (1B. Joyce). The index incorporates changes in temperature, precipitation, habitat types, and quality to rank areas on a gradient of high to low future climate stress.

The index shows that climate stress on terrestrial wildlife habitat is prominent along major boundaries of grassland and forest ecosystems and in areas of high topographic relief in the western states. Less sensitive geographic areas were found in the southern Great Plains, the southern borderlands with Mexico, the southern Mid-Atlantic states including the Appalachians, and the eastern coast of Florida (where effects associated with predicted sea level rise were not included). The states with the greatest proportional area of relatively high climate stress include Arkansas, Missouri, Iowa, and Nebraska.

The national index was adapted to evaluate habitat-specific risk to climate change in three case-study states - Arizona, Minnesota, and Tennessee - with results that show the geographic range of the greatest and least stress areas as well as the uncertainty associated with predicting stress. The analyses showed that many recommendations made in these states’ SWAPs – as well as those of many other states – are appropriate if the climate is stable but are likely to fail or be highly risky with changing climate. It may be necessary to expand the SWAP recommendations to comprehensively address diverse potential impacts of climate change.

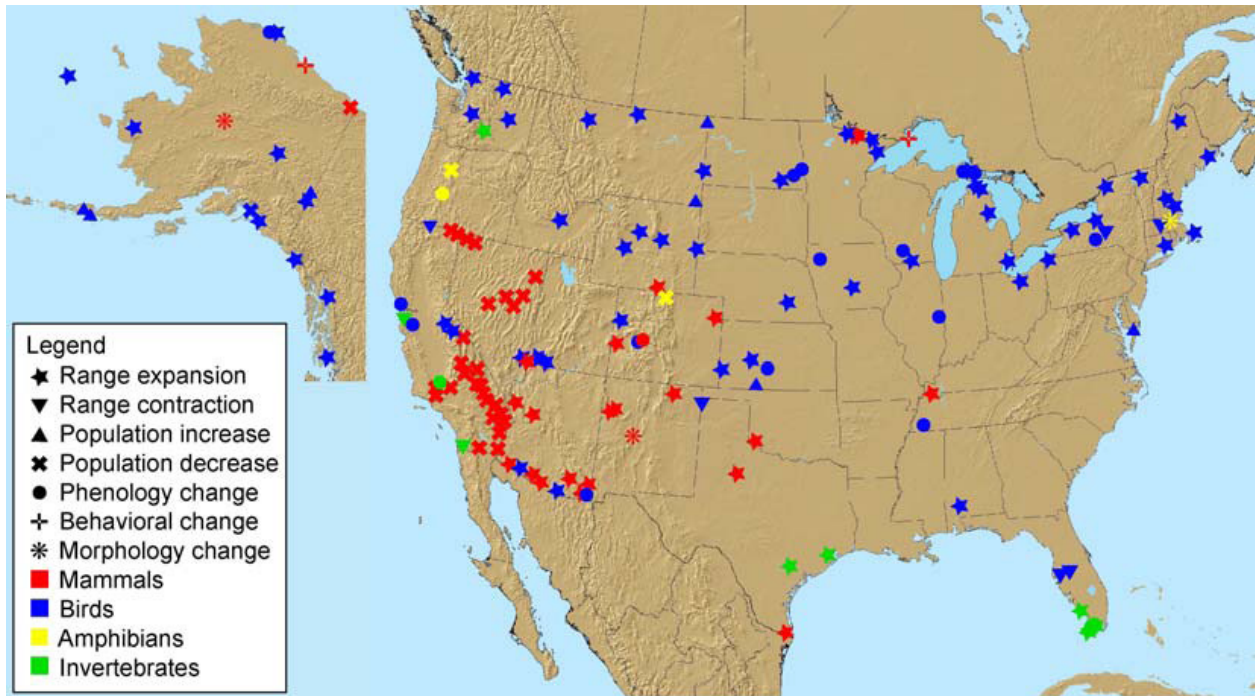
For example, Tennessee’s SWAP suggests reintroducing extirpated species of greatest conservation concern to their historical range, but such reintroductions could be prone to failure if future climate change in the area is not considered (1B. Joyce).



Indices from 12 different climate scenarios were averaged to produce this composite figure of hot spots of climate stress in the US. The most sensitive terrestrial areas (shown in dark blue) to climate change are associated with transitions between grassland and forest ecosystems and in the areas of high topographic relief. (1B. Joyce)

Climate stress on terrestrial wildlife habitat is not uniform, and we are learning more about where it will occur, how it will manifest itself, the magnitude of the impact, and the confidence of the impact result. Additional guidance for climate adaptation responses is becoming available, including ways to facilitate change to produce a desired set of conditions. The literature on this subject also includes background on initiatives and measures designed to reduce the vulnerability of natural and human systems to climate change impacts (1B. Joyce). For example, putting the SWAP habitat priority maps in the context of larger watershed-based initiatives can also be useful in developing climate adaptation strategies with a more integrated approach that includes economic, human, and infrastructure systems (2C. Wilkinson)

The potential impacts of climate change are multiple and interacting. For example, Arizona identified drought as the primary threat from climate change and made extensive recommendations for decreasing its impacts on wildlife habitat. Even in cases where other climate change impacts may be a more likely threat for a habitat, the SWAP recommendations for certain species only consider drought. An analysis that integrates consideration of multiple climate change threats in each habitat and area would offer states a mechanism for identifying a suite of management recommendations for wildlife habitat threatened by climate change (1B. Joyce).



Documented terrestrial wildlife response to observed changes in climate, based on 189 studies within the United States. No studies included Hawaii. (1B. Joyce)

Landscape-scale Planning

Natural resources management traditionally has been implemented under the assumption that weather patterns, species and habitat ranges, and other environmental factors will remain consistent with historical patterns. This is no longer the case, as climate change is having a considerable impact on the nation’s ecosystems that is very different from historical patterns.

As a framework for looking at ways to preserve biological diversity in the face of climate change, wildlife programs must move from a species focus to a habitat focus with an emphasis on landscapes. Interviews with state wildlife coordinators revealed that the new State Wildlife Action Plans are collectively promoting a shift to landscape-based conservation planning which will give them a better understanding of ways to adapt to climate change (1A. Davis).

A landscape focus provides a framework for encouraging other agencies, programs, and jurisdictions to protect and manage habitat. In addition, there are suggestions that climate change may cause ecological communities to disassemble and reorganize into new, unfamiliar associations of plants and animals. It will be difficult to monitor these changes unless we broaden our ecological focus and our conservation partnerships. Our understanding of the ecological context of habitats and natural communities is redefining how we design landscape-scale conservation planning to be better prepared to adapt to climate change impacts on fish, plants, and wildlife (2F. Kostyack).

Ecological Resilience

Conserving wildlife habitat can help communities be more resilient. Emerging insights from natural resource management suggest that adapting habitat for climate change can build resilience for both human and ecological systems. Ecological resilience refers to the capacity of an ecosystem to resist, recover, and

regenerate from disturbances or damage. Just as healthy humans are better able to deal with and recover from diseases and injuries, resilient ecosystems can cope more effectively with stresses and disturbances.

In general, diverse ecosystems are more resilient because there is a range of options for ecological change if one pathway is damaged. High levels of linkages between organisms within an ecosystem also increase the ecosystem's ability to absorb change.

Resilient ecosystems are important not only for protecting wildlife – the services that they provide to human communities can help people to be resilient. Ecosystem services will be especially important as climate change begins to impact weather, possibly bringing more severe storms and floods, rising sea level, and more extreme hot spells. Conserved habitat can mitigate climate change impacts and provide sites for adaptive response. It can be used to design human communities that maximize the range of ways that residents can respond to changing climate (2F. Kostyack).

D. A Path to Habitat Conservation

1. Building State Implementation Capacity

WHPRP-sponsored research has produced many capacity-building recommendations related to building skills. These included the importance of agencies developing new organizational competency in:

- assessing and predicting sustainability at the landscape scale
- spatially depicting goals and objectives that focus on measurable outcomes
- assessing and characterizing the sensitivity of species and habitats to changes such as climate stress.

The research also focused on how alignment and collaboration could effectively stretch an organization's capacity and ability to implement (1A. Davis).

Collaborative conservation produces a more unified voice for wildlife habitat conservation, increases federal and nonprofit organizational support, and raises matching funds for more diverse wildlife conservation. It will be important to support this work with more incentives for promoting investments where conservation interests align and for participatory outreach – as well as rethinking how we use existing habitat conservation funding (1E. McElfish).

For example, there is a compelling need to increase outreach to local and county government wildlife and conservation coordinators. Sixty percent of state officials who were interviewed commented on the challenge of engaging private landowners and local governments in planning and implementation efforts. In general, local governments have expressed a desire for clear guidance from the state on wildlife conservation priorities. States found that they could gain support and political momentum for implementing State Wildlife Action Plans by investing in local field agents to work with townships, counties, and watershed groups (1A. Davis).

As trends in spending patterns change there may be a need for state fish and wildlife agencies to create a new funding model that recognizes that Americans are choosing to spend their tax dollars differently and in ways that recognize a broader set of services and values behind wildlife habitat conservation. Much of this spending is coming through local government sponsored voter initiatives to support local land-use planning goals (Trust for Public Land, 2010).

2. Collaborating, Implementing, and Learning to Adapt

State wildlife agencies have long recognized the value of partnerships in developing shared goals and leveraging resources. Until very recently, however, land-conservation efforts aimed at maintaining habitat for wildlife diversity have been primarily ad hoc; state wildlife agencies' ability to buy land and easements are sometimes limited. Completing a wildlife habitat system for the nation will require providing states with new tools as well as linking individual state efforts. It will demand a more strategic and interdependent effort than states can manage individually, and state programs will have to move from species-based to habitat-based conservation (1A. Davis).

Collaborative Planning and Programs

Although current investments in land conservation are substantial, they are not large enough to complete a wildlife habitat system for the nation in 30 years. A mix of better program coordination, more strategic land protection, and new funding is needed to fill the gap (1E. McElfish).

Participants in successful collaborative planning efforts studied by WHPRP-sponsored researchers did not limit their focus to their own agenda, but worked to help other partners accomplish overall goals. In the South Puget Sound region of Washington, state, federal, and nongovernmental organizations are collaborating to restore prairie habitat. Participants see their efforts as one of the most successful examples of implementing Washington's SWAP primarily because the Washington Department of Fish and Wildlife was willing to look beyond the relatively narrow focus of its own plan and consider other interests (2A. Lauber).

Landscape-level Approach

In the examples of collaborative working teams, researchers found that blending different organizational goals often led to an expanding focus from species to habitats to landscapes to fully accommodate and leverage the planning focus of all the members (2A. Lauber).

Two Countries, One Forest (2c1forest.org), is a major Canadian-United States collaboration of conservation organizations, researchers, and foundations working to ensure that, despite political borders, the landscapes and communities of the 80-million-acre Northern Appalachian/Acadian ecoregion remain connected and adaptable as the climate changes. Their landscape-focused research is developing a set of values and threats maps that will guide conservation efforts. Their goal is to create a cross-border landscape linked by a network of wildlife habitat cores, corridors, buffers, and linkages.

In the southeastern United States, a multistate effort to protect the threatened gopher tortoise became much broader when members realized the tortoise requires intact longleaf pine habitat, which is also home to the endangered red-cockaded woodpecker. The vision of the working group grew to emphasize sustaining functional longleaf pine ecosystems with a full spectrum of ecological, economic, and social values, including the gopher tortoise, the red-cockaded woodpecker, and the human culture of the South's "piney woods" (2A. Lauber).

A preliminary step to thinking about habitat protection and climate adaptation at the landscape level is mapping priority areas: the desired landscape network has to be mapped. States that created maps as part of their wildlife action plans were found to be in a better position to achieve results because their intentions and goals are clearer.

Action Steps: Promote a landscape-scale approach to habitat protection

1. Develop more ways to communicate the value and relevance of landscape-scale conservation for habitat protection.
2. Find a way to map priorities; the states that created maps are maximizing the leverage of their programs.
3. Prioritize and implement appropriate projects to leverage additional resources through partnerships.
4. Pool resources to investigate opportunities to protect key habitats.
5. Work with partners to ensure that project implementation and habitat management are planned and occur across program and jurisdictional boundaries to maximize effectiveness.
6. Expand knowledge of resource conditions on the landscape with monitoring practices and be prepared to adapt management strategies.

Monitor Change and Adapt

State and federal wildlife agencies in the United States spend millions of dollars every year on projects intended to benefit wildlife species and their habitats, but how do we know whether these conservation measures are working? Robust and long-term monitoring systems can provide wildlife managers with early warnings about species decline, habitat threats, and ecological shifts to allow for adaptation strategies (1C. O'Malley).

Each SWAP already includes information that can be used to develop monitoring strategies for specific targets -- individual species, suites of species, or vegetation or ecosystem types. What is needed, in many cases, is to link the information contained in the state plans to monitoring and evaluation strategies that can help facilitate management in the face of uncertainty.

Action Steps: Monitor Change for Adaptive Resource Management

1. Select a conservation target or targets to monitor. At a minimum, states should monitor the extent of the key habitats identified in the SWAPs on a regular basis and track the amount of habitat currently in some form of conservation management.
2. Develop a conceptual model that relates conservation targets to stressors or threats, as well as conservation activities; simple conceptual models can be useful tools for helping wildlife managers see how management actions will lead to desired conservation outcomes.
3. Use the model to select potential indicators of target status and conservation effectiveness; report indicators for ecosystem/habitat extent, landscape pattern (e.g., fragmentation), and at risk species.
4. Implement conservation activities and develop a monitoring program to track and measure indicators.
5. Use the information to track progress, modify activities, and adjust the conceptual models.

The Nevada Wildlife Action Plan identifies 186 “species of greatest conservation need,” but significant data limitations for nearly all the species limited the success of existing monitoring efforts. In 2008, in partnership with The Heinz Center and the University of Nevada, Reno, the Nevada Department of Wildlife sponsored three workshops to identify indicators for monitoring the status of the target ecosystems and species in their wildlife plan and to develop a monitoring protocol for tracking the effectiveness of their conservation activities (Mawdsley, O’Malley 2009).

Given the constraints that Nevada – as well as most other states – works under with limited funding and limited data, the group chose two approaches to developing metrics: in-depth study of a few select species and summary statistics for a larger group of species that showed population trends for suites of multiple species from data sources around the country.

The effort is proving that a simpler and more accurate approach is available for measuring implementation activities for State Wildlife Action Plans – and that measuring fewer things well can still give a valid picture of progress, especially when matched with summary statistics from other organizations and some oversight from monitoring experts (IC. O’Malley).

The proposed pilot study anticipates three years of biannual sampling at a well-distributed set of study areas across the state to test its set of indicators and its monitoring framework. During the pilot studies, it is expected that ecosystem conditions will be identified to set a threshold level for management intervention or restoration action (The Heinz Center, 2009).

3. Catalyzing and Coordinating Investment

The next 30 years will be a critical period for protecting U.S. wildlife habitat. Developing a wildlife habitat system for the nation is important if we are to retain biodiversity, and it is the cornerstone of the nation’s efforts to protect biodiversity in a changing climate.

We are already spending a lot of money on land and habitat conservation through various state, federal, and private programs, each with its own goals and priorities. All are worthwhile and all are making some difference, but it is not clear that they add up to a biologically coherent whole.

Ensuring an integrated approach across federal, state, tribal, and local government boundaries will require a nationwide set of coordinated strategies – ones that reflect regional differences but add up to a comprehensive approach that can bridge the gap between current efforts and a completed system.

Now that state wildlife plans are complete and states have begun to implement them, the next step is to bring states together to integrate their efforts. Some standardization in data collection and use, valuation, and performance analysis is important for creating a national assessment of wildlife conservation progress that individual states can use for their own goal-setting (3A. Figg).

Current wildlife programs are proving to be catalytic for new initiatives and a new framework – a landscape-level approach – for wildlife conservation. Efforts must be made to create policy and funding incentives for monitoring and performance measures that can show collective progress across the states while strengthening the capacity of states to continue to take a leadership role in implementing and integrating their wildlife habitat plans.

Action Steps: Catalyze and Coordinate Conservation Investment

1. Creatively leverage limited resources by using State Wildlife Grant funds in an open competitive process to strengthen partnerships and align conservation priorities with other agencies and non-governmental organizations.
2. Build support for holistic wildlife programs by pooling expertise and limited resources to achieve habitat conservation goals; use the new coalitions to create and attract new public and private conservation funding.
3. Engage local governments with information and support that enables them to use State Wildlife Action Plans to reduce habitat loss from development.
4. Invest in projects with a strong participatory component and use the planning process to produce a more unified voice for wildlife habitat conservation.

(Source: 3A. Figg)

E. Conclusion

State Wildlife Action Plans have provided a blueprint for protecting our native wildlife species, and WHPRP-sponsored research results provide guidance for an implementation strategy. We are ahead of the game in that nearly half of the lands identified are already protected, and we know the approximate value and location of what still needs protecting.

We also have an estimate of what the country is currently spending on land conservation, as well as a general idea of how much of that money is going toward the protection of priority habitats identified in state plans. Various WHPRP projects show how to leverage limited wildlife protection spending with local and regional planning, state and federal mitigation efforts, and private sector incentives.

However, we also have identified a number of obstacles to moving forward. Sustainability of species and their habitats depends on outcomes manifested at the landscape scale, yet land-use changes – suburbanization, climate change, and biofuel development – are occurring at the site scale. To be effective, the fish and wildlife community will first have to move from a species focus to a habitat focus – a trend that is already beginning.

We now have enough knowledge to complete a wildlife habitat system for the nation in this century. Public interest in habitat protection is increasing, especially when habitats can be shown to perform multiple functions such as recreation and water quality protection as well as species protection, and voters have shown an interest in supporting funding measures for land conservation.

The most fundamental challenge to achieving this goal will be not be resources but a “new way of working” challenge that can ramp up implementation fast enough to halt the loss of fish and wildlife habitats to development. The conservation business models of most wildlife agencies and organizations are not a good match for the problems confronting wildlife conservation in this century – problems that transcend the boundaries of individual programs, agencies, and organizations and challenge traditional ways of thinking and doing. If we are to respond effectively to 21st Century challenges, transformational change will be needed in how wildlife agencies and organizations work, individually and collectively.

Studies of SWAP implementation show huge success in places where inter-agency collaboration, extensive partnerships, a landscape focus, and a commitment to goals that exceeded the grasp of any one organization are in place.

To achieve its ambitious goals, the fish and wildlife community will have to be extraordinarily persistent in moving toward a working model that recognizes not only the interconnections of conservation but an interconnected approach to collaboration that will enable the private, tribal, local, state, and federal conservation infrastructure to operate as a national network of partnerships that together can meet the goal of a wildlife habitat system for the nation.

Acknowledgements

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Two Countries, One Forest. www.2c1forest.org/

Appendix I. WHPRP Projects

(Please visit www.WHPRP.org for project details and reports)

Project codes are used in the report text for reference

1A: Initial Implementation of the State Wildlife Action Plans: Conservation Impacts, Challenges and Enabling Mechanisms

Principal Investigator: Frank Davis, University of California Santa Barbara

Co-Investigators: J. Michael Scott, Fish and Wildlife Resources, University of Idaho; Dale D. Goble, Law, University of Idaho

Project Steward: Sara Vickerman

Duration: Nov 2006 – April 2008

1B: Analysis of Potential Impacts of Climate Change on Wildlife Habitats in the U.S.

Principal Investigator: Linda Joyce, USDA Forest Service Rocky Mountain Research Station

Co-Investigator: Curt Flather, USDA Forest Service Rocky Mountain Research Station

Project Steward: John Kostyack

Duration: Nov 2006 – April 2008

1C: Measuring Results of the State Wildlife Action Plans

Principal Investigator: Robin O'Malley, The H. John Heinz III Center for Science, Economics, and the Environment

Co-Investigator: Kent Cavender-Bares, The H. John Heinz III Center for Science, Economics, and the Environment

Project Steward: Bob Szaro

Duration: Nov 2006 – Oct 2007

1D: Design of U.S. Habitat Banking Systems

Principal Investigator: Michael Bean, Environmental Defense

Co-Investigator: Jessica Wilkinson, Environmental Law Institute

Project Steward: Mike Harris

Duration: Nov 2006 – Oct 2007

1E: Analysis of U.S. State and Local Policies

Principal Investigator: James McElfish, Jr., Environmental Law Institute

Co-Investigator: Rebecca Kihslinger, Environmental Law Institute

Project Steward: Amy Ando

Duration: Nov 2006 – Oct 2007

1F: The Cost of a Comprehensive National Wildlife Habitat Conservation System

Principal Investigator: Frank Casey, Defenders of Wildlife

Co-Investigator: Timm Kroeger, Defenders of Wildlife

Project Steward: Alan Randall

Duration: Nov 2006 – April 2008

1G: Habitat conservation and provision of ecosystem services

Principal Investigator: Dean Urban, Duke University

Project Steward: Amy Ando

Duration: Nov 2006 – Oct 2007

1H: Development of an Operational Benefits Estimation Tool for the U.S.

Principal Investigator: Timm Kroeger, Defenders of Wildlife

Co-Investigator: John Loomis, Colorado State University

Project Steward: Alan Randall

Duration: Nov 2006 – April 2008

2A: Wildlife Funding/Policy Linkages: Using State Wildlife Action Plan Priorities to Shape Policies and Direct Expenditures at Multiple Levels of Government

Principal Investigator: Bruce Lauber, Cornell University

Co-Investigator: Richard Stedman, Cornell University

Project Steward: Peter Stein

Duration: April 2008 – Oct 2009

2B: Alignment of Land Conservation Spending with State Wildlife Action Plans

Principal Investigator: Frank Casey, Defenders of Wildlife

Co-Investigators: Katie Theoharides, Defenders of Wildlife; Andrew duMoulin, Trust for Public Land

Project Steward: Kim Elliman

Duration: April 2008 – Oct 2009

2C: Time Sensitivity of Priority Habitats

Principal Investigator: Jessica Wilkinson, Environmental Law Institute

Co-Investigators: David Theobald, Colorado State University; Bruce Stein, NatureServe

Project Steward: Sara Vickerman

Duration: April 2008 – May 2009

2D: Habitat Conservation Opportunities in Natural Hazard Areas

Principal Investigator: David Salvesen, University of North Carolina

Co-Investigators: Phil Burke, Univ. of North Carolina; Rebecca Kihslinger, Environmental Law Institute

Project Steward: John Kostyack

Duration: April 2008 – Oct 2009

2E: Impacts of Bioenergy Production on the Conservation of Wildlife Habitat

Principal Investigator: Robert Fletcher, University of Florida

Co-Investigator: Janaki Alavalapati, Virginia Tech

Project Steward: Mike Harris

Duration: April 2008 – Oct 2009

2F: Climate Adaptation Project and Adaptation 2009 Conference

Principal Investigator: John Kostyack, National Wildlife Federation

Duration: April 2008 – May 2009

3A: Wildlife Action Plan Coordinators and the Partnerships to Implement State Wildlife Action Plans Conference

Principal Investigator: Dennis Figg, Missouri Department of Conservation

Duration: Nov 2008 – Nov 2009

3B: The Next Generation of Mitigation: Linking Current and Future Mitigation

Principal Investigator: Jessica Wilkinson, Environmental Law Institute

Project Steward: Kim Elliman

Duration: Feb 2009 – June 2009

Appendix II. Program Publications

- Adrian, M., Lacher, I., Lue, E., Middleton, A. and Paludi, J. 2008. [A Distributed Graduate Seminar to Analyze the Priorities, Obstacles, and Opportunities that Exist for the Implementation of State Wildlife Action Plans](#). Masters thesis. Donald Bren School of Environmental Science and Management, University of California Santa Barbara. (WHPRP Project 1A)
- Aldridge, M., M. Jastremski, N. Lewis, S. Levy, A. Lowe, E. Michael, L. Pidot, C. Theriot and J. Visser. 2008. *State Wildlife Action Plans in the Northeast: A Regional Synthesis*. Masters thesis, School of Natural Resources and Environment, University of Michigan. Ann Arbor. (WHPRP Project 1A)
- Bean, Michael J. and Jessica Wilkinson. June 2008. "The Hope of Habitat Banking." The Wildlife Professional. (Feature story.) Bethesda, MD: The Wildlife Society. (WHPRP Project 1D)
- Bean, Michael, Rebecca Kihlslinger, and Jessica Wilkinson. February 2008. "Design of U.S. Habitat Banking Systems to Support the Conservation of Wildlife Habitat and At-Risk Species." Washington, DC: Environmental Law Institute. (WHPRP Project 1D)
- Davis, F., B. Griffith, S. Henke, L. Maguire, V. Meretsky, J. M. Scott, D. Goble, J. Vaughn, S. Yaffee and D. Stoms. 2008. Initial implementation of the State Wildlife Action Plans: Conservation impacts, challenges and enabling mechanisms. Final Report to the National Council for Science and the Environment's Wildlife Habitat Policy Research Program. University of California Santa Barbara (http://www.biogeog.ucsb.edu/SWAP/Docs/Misc/fdavis_WHPRP_final.pdf). (WHPRP Project 1A)
- Evans, J. M., R. J. Fletcher, Jr., and J. R. R. Alavalapati. 2010. Using species distribution models to identify suitable areas for biofuel feedstock production. *Global Change Biology Bioenergy*: in press. <http://www3.interscience.wiley.com/journal/122199998/issue>. (WHPRP Project 2E)
- Fletcher, R. J., Jr., B. A. Robertson, J. M. Evans, P. Doran, J. R. R. Alavalapati, and D. Schemske. 2010. Biodiversity conservation in the era of biofuels: risks and opportunities. *Frontiers in Ecology and the Environment*: in press. <http://www.esajournals.org/doi/abs/10.1890/090091>. (WHPRP Project 2E)
- Hayward, G.D., C.H. Flather, E. Uloth, H. Safford, and D. Cleaves. 2009. Managing fish and wildlife habitat in the face of climate change: USDA Forest Service perspective. *Transactions of the North American Wildlife and Natural Resources Conference*. 74:98-109. (WHPRP work is referenced on p. 103) (WHPRP Project 1B)
- Kihlslinger, R. & J. McElfish, *Nature-Friendly Land Use Practices at Multiples Scales* (ELI Press, Washington, DC. 2009) (WHPRP Project 1E)
- Kihlslinger, R., David Salvesen, and Tessa Lee. "Combining Habitat Conservation and Natural Hazards," *National Wetlands Newsletter*, Vol 32, No. 3. (WHPRP Project 2D)
- Lauber, T.B., R.C. Stedman, D.J. Decker, and B.A. Knuth. 2009. Using State Wildlife Action Plans to achieve your conservation goals through collaboration. HDRU Publ. No. 09-5. Dept. of Natural Resources, N.Y.S. Coll. Agric. and Life Sci., Cornell Univ., Ithaca, N.Y. 22 pp. (<http://www2.dnr.cornell.edu/hdru/PUBS/HDRUReport09-5.pdf>) (WHPRP Project 2A)
- Lauber, T.B., R.C. Stedman, D.J. Decker, and B.A. Knuth. 2009. Wildlife funding/policy linkages: using State Wildlife Action Plan priorities to shape policies and direct expenditures at multiple levels of

- government. HDRU Publ. No. 09-4. Dept. of Natural Resources, N.Y.S. Coll. Agric. and Life Sci., Cornell Univ., Ithaca, N.Y. 129 pp. (<http://www2.dnr.cornell.edu/hdru/PUBS/HDRUReport09-4.pdf>) (WHPRP Project 2A)
- Lauber, T.B., R.C. Stedman, D.J. Decker, and B.A. Knuth. Linking knowledge to action in collaborative conservation. In review, *Conservation Biology*. (WHPRP Project 2A)
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- Oswalt, S.N., M. Thompson, W.B. Smith. 2009. U.S. forest resource facts and historical trends. U.S. Department of Agriculture, Forest Service. FS-801. 56 p. (WHPRP is referenced on pages 42-43). (WHPRP Project 1B)
- Stoms, D. M., F. W. Davis and J. M. Scott. 2010. Implementation of State Wildlife Action Plans: Conservation impacts, challenges and enabling mechanisms. *Gap Analysis Bulletin* 17: 30-32 (<http://www.gap.uidaho.edu/bulletins/17/Stoms.pdf>). (WHPRP Project 1A)
- Theobald, David M., Jessica B. Wilkinson, and Pat Comer. 2009. "Time Sensitivity of Priority Habitats." Wildlife Habitat Policy Research Program. (WHPRP Project 2C)
- Wilkinson, Jessica B. and Robert Bendick. In press. "Applying 'The Next Generation of Mitigation' Concepts to the §404 Program." *National Wetlands Newsletter*. Washington, DC: Environmental Law Institute. (WHPRP Project 3B)
- Wilkinson, Jessica B. and Robert Bendick. January 2010. "The Next Generation of Mitigation: Advancing Conservation Through Landscape-Level Mitigation Planning." *Environmental Law Reporter*. 40 ELR 10023-10050. Washington, DC: Environmental Law Institute. (WHPRP Project 3B)
- Wilkinson, Jessica B., Robert Bendick, Bruce A. McKenney, James M. McElfish, Jr., and Rebecca Kih-slinger. August 4, 2009. "The Next Generation of Mitigation: Linking Current and Future Mitigation Programs with State Wildlife Action Plans and Other State and Regional Plans." (WHPRP Project 3B)

Appendix III. Participating Organizations

Stakeholder and Government Organizations

Alabama Division of Wildlife & Freshwater Fisheries	Maryland Department of Natural Resources
American Rivers	Michigan Dept. of Natural Resources
Arizona Game & Fish Department	Minnesota Dept. of Natural Resources
Arkansas Game and Fish Commission	Missouri Department of Conservation
Association of Fish and Wildlife Agencies	National Center for Conservation Science and Policy
Biophilia Foundation	National Council for Science and the Environment
Bipartisan Policy Center	National Phenology Network
Booz Allen Hamilton	National Tribal Environmental Council
California Department of Fish and Game	National Wildlife Federation
Clean Air Cool Planet	Natural Lands Trust
Colorado Division of Wildlife	Natural Resources Defense Council
Connecticut Dept. of Environmental Protection	NatureServe
Conservation International	NCASI
Defenders of Wildlife	Nebraska Game and Parks Commission
Delaware Division of Fish & Wildlife	Nevada Department of Wildlife
Department of Defense	New Hampshire Fish & Game Department
Doris Duke Charitable Foundation	New Jersey Div. of Fish & Wildlife
Earth Justice	New Mexico Department of Game & Fish
EcoAdapt	Nine Museums International
Eco-Associates, Inc.	NOAA
Environmental Defense	New York Department of Environmental Conservation
Environmental Law Institute	Oklahoma Dept of Wildlife Conservation
Environmental Protection Agency	Open Space Institute
Florida Fish and Wildlife Conservation Commission	Oregon Department of Fish and Wildlife
Georgia Dept of Natural Resources	Pacific Coast Federation of Fisherman's Associations (PCFFA)
Georgia Dept. of Fish and Game	Pacific Forest Trust
Georgia Wildlife Resources Division	Peconic Land Trust
Gordon and Betty Moore Foundation	Pennsylvania Fish & Boat Commission
Grand Traverse Regional Land Conservancy	Pennsylvania Game Commission
Heart of the Rockies Initiative	Rhode Island Dept of Environmental Mgmt.
Idaho Department of Natural Resources	Sierra Club
Idaho Department of Fish and Game	South Dakota Dept. of Game, Fish & Parks
Illinois Department of Natural Resources	Tennessee Wildlife Resources Agency
Institute for Ecosystem studies	Texas Parks and Wildlife Dept.
Iowa Dept. of Natural Resources	The H. John Heinz III Center for Sciences, Economics, and the Environment
Kansas Dept. of Wildlife and Parks	The Nature Conservancy
Kentucky Dept of Fish & Wildlife Resources	The Wildlife Society
Land Trust Alliance	Theodore Roosevelt Conservation Partnership
Lyme Timber Company	Tides Foundation/ Island Press
Massachusetts Audubon Society	Tennessee Fish and Wildlife
Maine Coast Heritage Trust	Trout Unlimited
Maine Dept. of Inland Fisheries & Wildlife	
Manomet Center for Conservation Science	
Massachusetts Div. of Fisheries and Wildlife	

Trust for Public Land
U.S. Dept of Agriculture, Forest Service
U.S. Dept of Interior, Bureau of Land Management
U.S. Fish and Wildlife Service
U.S. GAO
U.S. Geological Survey
Utah Wildlife
Virginia Dept. of Game & Inland Fisheries

Washington Department of Fish and Wildlife
Wilburforce Foundation
Wilderness Society
Wildlife Conservation Society
Wildlife Management Institute
Wisconsin Department of Natural Resources
World Wildlife Fund
Wyoming Game and Fish Department

Universities

Colorado State University
Cornell University
Duke University
Louisiana State University
Oregon State University
The Ohio State University
University of California – Santa Barbara
University of Florida

University of Georgia, Extension
University of Idaho
University of Illinois
University of Maryland
University of Miami
University of North Carolina
University of Washington
Virginia Tech