National Stewardship Initiatives
Conservation Strategies for U.S. Land Owners

by Sara Vickerman

Author and Project Manager:

Sara Vickerman, Director of West Coast Programs, Defenders of Wildlife

Production Managers:

Roger DiSilvestro, Director of Special Communications Projects and Deputy Editor, Defenders of Wildlife
Maureen Hearn, Editorial Associate

Contributors:

Peter A. Levigne, Watershed Consulting, and Charlie Blumenstein, Contract Research Assistant

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Bruce Taylor, Project Manager for Defenders of Wildlife's Oregon Biodiversity Project, and Wendy Hudson, Program Associate for Defenders West Coast Office assisted with writing, organization, and editing of this report.

ABOUT DEFENDERS

Defenders of Wildlife is a nonprofit organization of more than 230,000 members and supporters nationwide with its headquarters located in Washington, D. C. *Defenders' focus is on conserving, enhancing, and restoring wildlife and habitats with an emphasis on native ecosystems. The west Coast Office has emphasized alternative approaches to environmental decision-making through partnerships that engage a broad spectrum of participants in processes that help people with divergent interests find common ground and constructive solutions.*

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Stewardship Incentives Report: Conservation Strategies for Oregon's Working Landscape. By Sara Vickerman. January 1998.

Oregon's Living Landscape: Strategies and Opportunities to Conserve Biodiversity. March 1998.

Oregon venture Highlights Biodiversity. By Kristin Hannum. March 1998.

Oregon Biodiversity Project CD-ROM. (Contains data sets used in the statewide biodiversity analysis, plus visualization software). March 1998.

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Introduction

Since 1960, the population of the United States has increased by nearly 90 million to approximately 268 million. Over the same period, population densities have increased in the areas most important to biodiversity - along our coasts, estuaries, rivers, and streams. In 1990, approximately 75 percent of the population lived within 50 miles of the Atlantic, Gulf, Pacific, and Great Lakes coasts (Save the Bay 1987).

Human activities on the landscape have inadvertently caused a biodiversity crisis in the United States. Land use and management have fragmented wildlife habitat and harmed a number of plant and animal species. Existing systems for managing information on the distribution of wildlife, habitat, and land-use patterns are inconsistent and incomplete. Existing laws have not effectively reversed species declines and are unlikely to prevent additional species from becoming endangered.

Studies by several organizations consistently show about one third of U.S. plant and animal species at risk of extinction (The Nature Conservancy 1990, 1997, American Fisheries Society 1991, Cairns et al. 1992). The evidence is sobering:

- More than 200 species of plants and 71 species and subspecies of vertebrates have gone extinct in North America north of Mexico since the advent of European settlement (Stein and Flack 1997).
- More than 3,000 species await listing under the federal Endangered Species Act. Since the act was enacted in 1973, only a handful of species have recovered to the point of being completely removed from the federal endangered species list (Noss and Cooperrider 1994).
- A third of all native freshwater fish species in the United States are threatened or endangered, as are two-thirds of all freshwater mussels and nearly three-quarters of freshwater crayfish (Master 1990).
- Among anadromous fish, 214 salmon and steelhead fish stocks in the Pacific Northwest are now threatened, and 101 of these are near extinction (Nehlsen et al. 1991). Eastern anadromous fish species - the Atlantic salmon and shad - are gone from most of their original spawning grounds because of dams, riverside development, and pollution (Steinberg 1991).
- Nearly a third of North America's 86 species of frog and toad may be endangered or extinct (Yoffe 1992). Reasons for their decline are poorly understood, though many scientists see amphibians as important indicators of overall environmental quality.
- Grizzly bears, wolves, cougars, and other large carnivores have virtually disappeared from many areas where they were formerly abundant. Their need for large home ranges and tendency to scare people and to compete with them for food have resulted in campaigns to eliminate them from places in which conflicts occur. Carnivores are important indicators of ecosystem health, and their protection stands out as a symbol of society's commitment to wildlife conservation. Conserving a full array of biological diversity requires that we make room for large predators (Noss and Cooperrider 1994).

Many of the species declines noted above are caused by conversion of native vegetation to agriculture, urban development, and other uses. Entire ecosystems and associated species have suffered severe declines. Some of the most endangered ecosystems in the United States include Southern California coastal sage scrub, longleaf pine forests and savannas, tallgrass prairies, Hawaiian dry forests, old-growth forests of the Pacific Northwest, and midwestern wetlands (Noss and Peters 1995).

This report is an outgrowth of similar reports focused on the State of Oregon. The first one, Stewardship Incentives: Conservation Strategies for Oregon's Working Landscape, and a companion document, Oregon s Living Landscape:

Strategies and Opportunities to Conserve Biodiversity, were written as part of the Oregon Biodiversity Project. The project is one of the first attempts to look holistically at natural resources on a statewide basis to begin developing a long-term conservation strategy. Although the initial focus was on the identification of habitats poorly represented in the existing mix of conservation lands, it became obvious early on that a strategy which relies only on establishing additional reserves cannot protect the full range of natural communities. Since many elements of our biological heritage exist in the managed landscape, lands used primarily for farming, timber production, housing, and recreation will play an increasing role in maintaining biodiversity and supporting a high quality of life.

This report addresses some of the policies and practices that can be implemented as a part of a larger strategy to reverse the trends causing stress to U.S. wildlife and ecosystems. It offers a range of incentives and management recommendations for biodiversity conservation on lands managed primarily for commodity production and other human uses. It provides a range of incentive options that currently exist or that could be implemented to encourage improved stewardship on managed lands across the nation. It describes specific strategies to enhance biodiversity on lands managed primarily for human uses and defines a positive role in biodiversity conservation for private landowners, highlighting contributions they often already make. The primary audience is private landowners, resource managers, policy makers, and others interested in conserving wildlife, habitat, and other elements of biodiversity on the managed landscape.

Nationwide, numerous groups have organized similar discourses on conservation incentives, usually with an intent to identify incentives acceptable to a broad range of participants. The disadvantage of such a consensus approach is its tendency to eliminate some meritorious options from consideration. This report presents a broad range of options for which readers are invited to weigh the merits.

For the purpose of this report, we define incentives broadly to include anything that may motivate people to adopt improved land-management practices to conserve biodiversity. Based on extensive research and personal interviews, we looked at any activity that could be initiated by a public or private organization or individual to encourage improved stewardship with an emphasis on land management. Since people and institutions are motivated by a wide variety of different factors, we did not limit our scope to economic or market incentives. This report does not address market-based incentives (such as pollution trading and discharge fees) that apply to industrial processes. Although such incentives are important to maintaining biodiversity, they are typically applied within a regulatory context, which is beyond the scope of this report.

We also applied the concept of biodiversity broadly to encompass ecological elements and processes well beyond individual species since healthy soils, clean water, and natural disturbances are all essential to the long-term maintenance of wildlife and habitats.

Finally, this report is based on a number of assumptions and principles:

- Biodiversity cannot be conserved adequately through the creation of reserves and regulation alone. Although these techniques have resulted in important conservation benefits, many landowners feel burdened by existing regulations and are unlikely to support additional restrictions. Balancing regulations and acquisition strategies with incentives should produce significant benefits.
- The managed landscape can support important elements of biodiversity while meeting human needs. Even the most intensively developed and managed landscape can support biodiversity goals. For example, urban areas can support some native birds (e.g., peregrine falcon). Many species favor agricultural lands (sometimes to the chagrin of the landowner). Wildlife species favoring early- and mid-successional habitats may thrive in managed forests. However, species with unique or specialized habitat needs may require refuges, protected areas, or restoration and/or enhancement of habitat to survive.
- Some lands may be managed intensively to spare others from development. For example, housing density is encouraged within urban growth boundaries drawn around cities to save open space, farmland, and forest land in rural areas. Federal forests provide more late-successional habitat for fish and wildlife, while private lands are more likely to be managed to maximize timber production. Intensive, high-yield farming can produce more food on fewer acres, thereby reducing pressure on wildlands. A practical biodiversity strategy acknowledges the importance of zoning as a management tool.
- Sufficient information is available about biodiversity management to take action on the ground, even though data gaps exist. Throughout the process, we found areas of agreement among public and private landowners, conservationists, and industry leaders on actions that could be taken to enhance stewardship. Recommendations in this report focus on these areas of agreement.
- Given the correct circumstances, landowners and managers will take steps to conserve wildlife, plant communities,

and ecological processes. Favorable circumstances will vary according to a manager's personal priorities and values, financial situation, age, land-management objectives, and other factors.

- Financial resources to provide incentives will be limited as agency budgets decline. Emphasis should be placed on incentive programs that do not require massive increases in resource-agency budgets. Incentive programs, particularly those addressing regulatory relief, need not be costly. A reallocation of existing budgets may be appropriate. Ultimately, changes in the system are needed that will simultaneously generate revenue from activities harmful to biodiversity and contribute to more sustainable practices.
- Policies at all levels of government can help or hinder biodiversity conservation efforts. Some policies may inadvertently discourage conservation but could be modified to correct the negative influence. For example, some Oregon landowners are reluctant to restore riparian lands by planting trees that may be harvested later. Their reluctance stems from a fear that they will be regulated by the Oregon Forest Practices Act, putting additional limitations and permit requirements on their activities. In addition, some federal programs encourage activities that may cause adverse impacts to biodiversity.
- An incentive program should give people credit for improved stewardship even if "perfection" is not reached. Land-management objectives will differ, and implementing improved practices takes time. Continuous improvement should be encouraged and rewarded.
- A conservation incentive program should offer something meaningful for everyone. Even if primary gains are to be made on agriculture and forestry lands, urban residents can play an important role. For example, accepting high-density housing to save open space elsewhere and landscaping with native plants can help conserve biodiversity.
- Landowners and managers need to see the larger context to determine where they fit in and what they can do to conserve biodiversity. Being part of a regional plan or broader effort will produce greater benefits for all participants.
- One size does not fit all. A good incentive program is flexible enough to accommodate different circumstances and new information and ideas.
- Incentives should supplement - not replace - regulation. Regulation effectively controls certain activities that damage the environment and serves to identify an expected level of stewardship. Incentives can promote additional care of certain public values on resource lands.
- Specific goals are needed for incentive programs. To ensure that results are achieved on the ground, specific management targets that can be measured over time must be established. A good monitoring program is important.

As the nation approaches the 21st century, a growing population promises to have profound impacts across the landscape. The responsibility of ensuring the survival of vigorous and diverse wildlife populations is an immense and daunting challenge. Defenders of Wildlife offers this report as an encouragement to landowners looking for constructive measures to assist them with sound stewardship of the nation's natural resources.

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SECTION ONE Part I

Biological Diversity

Any meaningful discussion of land use first requires an understanding of biological diversity, or biodiversity. Definitions of biodiversity can vary. For our purposes, we define it as the "entire spectrum of life forms and the many ecological processes that support them." (Wisconsin Department of Natural Resources 1995). Biodiversity generally occurs at four interactive levels:
Genetic: the diversity of genetic material carried by all individuals of a particular species.
Species: the variety and distribution of species within a geographic area.
Community/Ecosystem: Communities are assemblages of plants and animals, usually named by the dominant vegetation type (e.g., ponderosa pine forest community). Ecosystems are the complex of biological communities and the ecological processes sustaining them.
Landscape/Regional: Landscapes are the complex of interacting ecosystems that distinguish one area from another. Regions are composed of several landscapes exhibiting a common species composition, physiography, climate, and soil (Wisconsin DNR 1995).

Biodiversity includes dynamic ecological processes. Ecosystems and communities are in a constant state of change driven by natural processes such as fire and other natural events. Humans can affect ecosystem processes either deliberately or inadvertently through various activities on the landscape (Wisconsin DNR 1995).

Traditional conservation strategies have favored pieces of the puzzle (typically, individual species) rather than the whole ecosystem or community. As a result, some important elements of biodiversity - certain community types and ecosystems - have been overlooked. For this report, our focus is on maintaining native plants and animals and the communities and ecosystems in which they occur. Such a broad assessment may help address these gaps in protection before they become crises. Addressing the gaps will require a range of strategies, including the establishment of reserves, which may be either public or privately owned lands managed primarily to conserve native biodiversity. However, it will also require attention to lands that are managed principally for other purposes, such as agriculture, forestry, recreation, or housing, but where biodiversity goals are recognized and integrated as important secondary purposes.

IMPORTANCE OF BIODIVERSITY

Biodiversity is important because it has intrinsic worth. It also adds variety and interest to our daily lives, thereby enhancing our appreciation and aesthetic enjoyment of nature. In a world that tends to place stronger emphasis on monetary value, these values are often underemphasized. We place them first in this report and offer in addition the following practical reasons:
* Biodiversity supports the integrity of the ecological systems upon which humans depend, provides genetic material for new agricultural and silvicultural crops, and provides the resilience necessary for ecosystems to withstand climatic changes, disease and pest outbreaks, and other environmental stresses (Keystone Center 1991).
* Nearly half the world s medicines are derived from living plants or animals, and the potential exists to develop additional pharmaceutical products as new species are screened (Keystone Center 1991).
* Biodiversity conservation makes good economic sense. Humans are dependent on natural resources for commodities such as forage for livestock and lumber for homes as well as for ecological services such as flood control, waste detoxification, and creation of soil (Brussard 1994).
* Effective biodiversity-conservation programs could help limit economic impacts of the Endangered Species

Act by reducing the ecosystem degradation that leads to listings (Brussard 1994).

SCALE AND CONTEXT

Effectively conserving biodiversity requires an approach that considers both scale and context. Scale refers to both space and time. Spatial scale is important because many conservation actions are undertaken on small sites without regard to larger ecological patterns and processes. For example, protecting a rare plant within a five-acre reserve may seem like a good idea, but the site may not be large enough to accommodate environmental disturbances that are characteristic of the ecosystem in which the plant evolved. A consideration of the larger landscape pattern and associated disturbances will be needed if ecological processes are to be maintained.

Similarly, temporal scale is important to biodiversity management. Short-term land- and wildlife-management decisions may not be ecologically beneficial in the long run. For example, attempting to maintain a forest ecosystem in the same condition over a long period of time may not produce desired results if the ecosystem evolved with disturbances that created openings and a patchy landscape.

Context is similarly important. Context refers to the biotic composition of the surrounding region and the activities taking place on adjacent lands. Failure to consider context can undermine the effectiveness of conservation actions taken by landowners. Context is particularly important in conserving aquatic systems. Since streams cross multiple ownerships, poor land-management practices downstream can negate the benefits of restoration efforts upstream and vice versa. For example, improved forest practices can produce clean water flowing from mountainous areas. As the streams enter urban and agricultural areas in the lowlands, they still may become contaminated if systems are not in place to control sedimentation and chemical pollutants.

Unfortunately, jurisdictional boundaries rarely match up well with ecological processes. Problems with scale and context will continue because scales appropriate for management of one process may not be appropriate for the management of others. Watersheds are an excellent unit for hydrologic processes, but do not define appropriate units for fire, wildlife, or even other processes tied to streams (Christensen 1997).

Planning that appropriately considers scale and context can benefit landowners in a variety of ways. For example, in western Oregon, a portion of federal forests are managed to maintain or develop old-growth characteristics. If adjacent private lands are managed to produce timber and to provide habitat for early- and mid-successional species, then biodiversity can be addressed on a regional basis.

INTEGRATED PLANNING AND MANAGEMENT

Since the concept of biodiversity is so broad and interpreted differently by many interests, specific management goals, objectives, and targets are essential to conservation programs. For example, programs may focus on enhancing areas with native vegetation, reducing the amount of land dominated by invasive exotic plants or reducing numbers of harmful species. Monitoring is essential to determine when goals are being met (Brussard 1997).

A more integrated approach to planning at every level of government is needed to conserve ecosystems while meeting the needs of present and future generations of humans. According to Steven Yaffee, we have created "environmental nightmares" because of our tendency to focus on short-term fixes, to procrastinate, to defend our institutional turf, and to implement piecemeal solutions to cross-cutting problems (Yaffee 1997). Yaffee proposes a new model that encourages more cooperative behavior, and better communication, innovation, and accountability. The new model is summarized in the table (below).

INTEGRATED PLANNING: A NEW MODEL.

Behavioral Bias	Policy Problems Created	Solutions
Short-term rationality out	Poor long-term direction	*Learn about the future. *Commit to the future through

competes long-term rationality		directives, information, and "fixers" (involvement of outside groups that focus on the future). *Promote innovation and experimentation. *Find creative ways to meet both short-term and long-term objectives.
Competition supplants cooperation	Impasses; inferior solutions	*Deep trust, relationships, and processes that promote sharing. *Protect the potentially exploited. *Focus on the most important goals. Be firm on the ends and flexible on the means to reach the ends.
Fragmentation of interests and values	Impasses; inferior solutions	*Promote discourse and values ratification. *Build political concurrence. *Promote education.
Fragmentation of responsibilities and authorities	Slow and inconclusive decision-making; diminished accountability; piecemeal solutions	*Foster leadership. *Create coordinating mechanisms. *Structure incentives. *Develop clear measures of success and an ability to monitor performance.
Fragmentation of information and knowledge	Inferior solutions	*Promote information flows within and between organizations. *Invest in better databases. *Build centers of up-to-date expertise. Use data negotiation (debate and discussion between conflicting sources of expertise).
Adapted from: Yaffee, Steven. 1997. "Why environmental nightmares recur." *Conservation Biology*, vol. 2, no. 2.		

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SECTION ONE Part II

Biological Diversity continued

BIODIVERSITY CONSERVATION

In some circles, conserving biodiversity is synonymous with establishing reserves where nature operates relatively free of human interference. For several reasons, however, biodiversity cannot be conserved solely through a strategy of establishing reserves:

- There will never be enough reserves, political support, or financial resources to acquire enough land to support all elements of biodiversity.
- Many reserves are either too small to sustain genetic and species diversity or are located in high-elevation areas where species abundance and diversity are low. Some of the most biologically important lands are at lower elevations and in private ownership. Many are used for agriculture.
- Reserves imply a separateness that makes political support difficult to generate and sustain.
- Private lands support significant elements of biodiversity and so cannot be ignored. Given the proper incentives, private lands could play a much greater role in protecting biodiversity.

Flexible and Dynamic Management Approaches

Our existing system of land-use planning, state and federal laws and regulations, and tax policy was not developed with biodiversity conservation goals in mind. With the possible exception of management decisions made under the federal Endangered Species Act and Clean Water Acts, most decisions that affect managed lands are driven by markets and social interests, not by conservation goals. The challenge is to implement flexible and dynamic management approaches that integrate conservation goals with economic and social interests.

In 1993, the President's Council on Environmental Quality produced a blueprint for biodiversity protection on private lands. The report identified four goals: 1) maintain the viability of native plants and animals; 2) encourage the restoration of viable plants and animals; 3) complement regional and global biodiversity efforts; and 4) educate employees, community leaders, and the public about biodiversity conservation (Cubbage 1997).

The table (below) summarizes some contemporary, integrated management approaches compared to more traditional approaches. It examines a few of the critical issues in resource management and highlights the importance of addressing entire ecosystems over long periods of time rather than looking only at small pieces of the puzzle on a short-term basis.

Two specific, integrated, dynamic management approaches that have found widespread support in recent years are ecosystem management and adaptive management. Ecosystem management has emerged as an important concept among most federal agencies and many large private land managers. Although a widely accepted definition has not emerged, some common elements have been identified:

- Ecosystem management is holistic, incorporating all elements of the ecosystem, biological and physical, and their interrelationships as currently understood.

- Sustainability is an essential element and precondition. The biological diversity, evolutionary potential, and productive capability of the system must be maintained.
- Human use and activities are integral parts of ecosystem management but must be designed to meet sustainability goals (Haeuber and Franklin 1996).

Nels and Barrett provide an example of this new, integrated approach as it is being implemented in the Connecticut River Tidelands ecosystem. The goal of the Tidelands Program is to protect the marsh and river ecosystem, including rare species and communities, water-quality, and ecological processes. It includes land protection, biological monitoring and management, research, water quality monitoring and pollution control, restoration, government relations, and outreach. A similar approach is used in the Klamath Basin on the Oregon-California border.

Although principles of ecosystem management are gaining acceptance within the resource-management community, practical, on-the-ground models and applications are not easily determined. Ecosystem management introduces so many complexities that it is difficult for people to comprehend and manage. Therefore, ecosystem approaches must encompass the concept of adaptive management - a practice-based approach in which management actions are undertaken, monitored, and adjusted as new information becomes available (Brunner and Clark 1997).

The principle of adaptive management is based on the recognition that fundamentally we know very little about how ecosystems function and that we must carefully monitor our actions to determine whether we are meeting management goals. It also recognizes the importance of incorporating new information as it becomes available.

SUMMARY OF TRADITIONAL AND INTEGRATED APPROACHES TO MANAGEMENT.

	Traditional Approaches	**Contemporary, integrated approaches**
Emphasis	Stability and persistence of objects, structural completeness	Structural context and dynamic processes, historical contingency
Scale	Generally small; set by size of object (fine filter; small extent)	Generally large, set by range of processes (variable filter; large extent)
Partnership	Competitive or isolated party lines, cooperation not emphasized	Interdisciplinary communication and cooperation vital
Management	Benign neglect, to passive or limited management	Active management of processes and structure

Adapted from: Barrett, Nels E. and Juliana P. Barrett. 1997. "Reserve design and the new conservation theory." *The Ecological Basis for conservation.* S.T.A. Pickett, R.S. Ostfeld, M. Shack, and G.E. Likens (eds.) Chapman and Hall. New York.

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SECTION TWO Part I

Conservation Incentives

The notion of stewardship incentives suggests different things to different people. Some imagine market-based incentives in which purchasing decisions by consumers stimulate improved management. Others envision direct financial support for habitat restoration or land protection. Some focus on technical assistance or recognition as rewards for good stewardship. For the purpose of this report we define incentives broadly to include *anything that might motivate people to adopt improved land-management practices to conserve biodiversity.*

DIFFERENT TYPES OF INCENTIVE PROGRAMS

A number of different kinds of incentive programs are available or have been proposed. A comprehensive list of these options, compiled from many sources and organized by incentive category, can be found in Appendix A. The broad categories are discussed briefly here.

Direct financial assistance can be offered to encourage landowner participation in conservation land management. For example, lands or easements can be purchased directly. Payments can be used to offset loss in revenue when lands are taken out of production or when production is reduced. Tax credits or deductions can be used in addition to or instead of direct payments. Direct financial assistance is appealing to some landowners, but is not without drawbacks. On one hand, landowners may be reluctant to accept financial assistance for fear of attached strings. On the other, taxpayers may expect more direct benefits to accrue when taxes fund improvements on private lands.

Educational programs and technical support are important components of any incentive program. Landowners are more likely to make investments in habitat if they have good information about how to implement management changes and about the results and benefits of their actions. Educating the broader public about the need for good stewardship and the benefits associated with ecosystem management is also important.

Good information for cooperative planning can help all parties adopt improved management strategies. Accurate maps, knowledge about the location of sensitive habitats, and reasonable assurance that expectations of regulators will not be constantly shifting all contribute to a climate in which people might be more willing to participate in collective conservation efforts. Lack of easy access to quality information has been a significant barrier to the development and implementation of conservation plans. The existence of any overlapping planning jurisdictions and processes often presents a set of bewildering, inefficient, and expensive options for landowners.

Regulatory relief is often cited as a primary goal of landowners. Many feel overburdened by existing regulations that are sometimes contradictory from one agency to the next. Some landowners feel that the existing mix of requirements does not encourage voluntary investments in conservation. Examples of regulatory relief are numerous and include such high-visibility examples as habitat-conservation planning in which landowners receive permits to take endangered species if they comply with a long-term conservation agreement for their lands. Alternative compliance has been proposed as a similar strategy to meet environmental goals without requiring landowners to follow detailed, prescriptive regulations, thereby shifting the focus from activities to results.

Public recognition and personal benefits may motivate landowners and managers to adopt good stewardship practices. Some just enjoy the benefits of seeing wildlife and conserving the natural surroundings. Others may be motivated by awards or the recognition of their friends and neighbors. Recognition for good stewardship has broad support and need not be expensive. It can also be used to motivate managers of public and corporate lands to do a better job.

Market-based incentives encourage conservation-oriented economic development. One of the most ambitious efforts is the Shorebank Enterprise Group, in Ilwaco, Washington. The group offers marketing services, technical assistance, and high-risk nonbank credit to rural entrepreneurs (Northwest Policy Center 1997).

Market-based incentives are also based on the assumption that products carrying a green label will perform better in the market place. Some examples include organic foods, products with recycled material content, and certified wood products. Specific examples include:

- The Pacific Rivers Council, which promotes a salmon-safe label for foods grown in a manner compatible with the conservation of fish and fish habitat. Grocery chains in 13 western states recently have adopted the salmon-safe labeling.
- The SmartWood certification program, a project of The Rainforest Alliance, which certifies timber companies and secondary manufacturers for processing products made with certified wood (Gretzinger 1997). SmartWood partnerships with the Sigurd Olson Environmental Institute in Wisconsin and with regional certification partners in other areas and countries have spurred certification efforts on public and private timberlands throughout the world.
- Audubon International of New York, which certifies U.S. golf courses that meet certain environmental-management standards.

The proliferation of certification programs and the inability of consumers to determine what they really mean may inhibit their utility as an incentive option. The Institute of Agriculture and Trade Policy, based in Minneapolis, Minnesota, is tracking and supporting green label marketing around the world.

INHERENT WEAKNESSES

Across the nation, a sometimes odd assortment of incentives and disincentives has arisen in response to specific circumstances. A lack of overall, coordinated planning is conspicuous. This section looks briefly at some of the reasons why incentives do not always succeed and how disincentives similarly limit success.

Incentives

Many programs are already in place throughout the country that may assist private landowners in managing lands for biodiversity. Among these are educational programs, collaborative planning processes, and efforts to streamline regulations. In addition, a number of private organizations are working to conserve wildlife habitat and promote more sustainable management of resources. These programs provide certain incentives and encouragement to landowners that are essential to conservation and will continue to make an important contribution.

Collectively, however, the existing incentive programs have not been sufficient to conserve biodiversity effectively. Some incentive programs were established with other primary goals in mind. For example, the farm commodity programs were designed to stabilize farm prices. Forest assistance programs were aimed at increasing timber production. There may be opportunities to fine-tune these programs to encourage better stewardship in addition to their primary purposes.

Some incentive programs fail because people are unaware of them and consequently do not apply for them. Marketing or advertising of conservation programs to potential participants is often weak. Existing incentive programs are administered by many different agencies and organizations according to very different guidelines and funding cycles, and no central location exists for information about where to apply for assistance.

Some programs look good on paper but are inadequately funded. For example, the federal Land and Water

Conservation Fund was used in the past to assist state and local governments in purchasing land for recreation and conservation. Congress, however, has not provided funds for this part of the program in recent years. Even if funds are available for landowner assistance, agencies often lack the personnel to administer the programs and to provide the technical assistance needed for successful project design, implementation, and monitoring. The Natural Resource Conservation Service, U.S. Fish and Wildlife Service, and many state agencies have a significant backlog of requests for assistance.

Most existing programs have a narrow focus, specific allocation criteria, limited eligibility requirements, and other complicated features. People fail to apply because of the paperwork, because agencies channel funding into projects of marginal utility simply to fit the guidelines, and because agencies finance many small, unrelated projects lacking a coherent overall plan in which ecological results can be determined over a wide area and long time frame. These complexities are exacerbated by the fact that many different agencies administer the programs.

The need is clear for better coordination among state, federal, and private land managers and for a strategic conservation framework in which many small projects undertaken by individuals can achieve a common vision.

Disincentives

Disincentives (sometimes called perverse incentives) inadvertently discourage people from practicing good stewardship. Many private landowners shudder at the thought of having an endangered species occupy their land because they fear the federal government will limit their ability to use the land (Rochelle 1996, Starker 1996). In extreme cases, landowners might consider removing the endangered species to avoid the associated complications (Bean and Wilcove 1997, Mann and Plummer 1995).

Private landowners who already practice good stewardship and are willing to make investments to enhance biodiversity on their lands may be reluctant to continue doing so because of the inherent uncertainty about regulations that might be imposed by the government (Starker 1996).

Moreover, landowners are sometimes reluctant to accept assistance from a government agency because they fear that an expenditure of public funds might imply a right of public access to private lands. Private landowners have limited capabilities to manage recreational use of their properties and to control vandalism (Smith, S. 1996).

State land-use laws can inadvertently discourage landowners from improving habitat. For example, if a wetland is created on private land, future use of the land for other purposes can be limited (O'Toole 1997).

CRITERIA FOR EFFECTIVE INCENTIVE PROGRAMS

In general, incentive programs will be effective only if landowners see how participation will serve their interests. The type of incentive programs we describe either reward choices that are consistent with conservation or remove barriers to adopting management for conservation. In trying to predict how successful each of these programs might be, the following considerations should be kept in mind:

- Is the reward big enough to induce landowners to take a significant loss to themselves? While public recognition and awards motivate some people, purchase of lands or easements for conservation or payments for environmental services are among the most direct (and most costly) means of matching the reward to the effort. If the payment is not high enough, landowners simply will not participate or will bargain for more.
- While it is often not possible to fund programs that make direct payments, it may be possible to reward conservation effort indirectly. Some programs can make land management less costly by removing administrative obstacles, streamlining regulations, making information available and easy to understand, or providing stability or reducing uncertainty. For example, a no-surprises policy in habitat-conservation planning allows landowners to incur some known cost of altering land-management activities in return for the intangible benefit of knowing what they will be allowed to do in the future. However, these programs need to be structured in a manner that permits adjustment in light of changing conditions or new information.

- Do participants in the program face unrecognized costs? Certification is becoming increasingly popular as a way to provide financial incentives to producers and landowners to manage for conservation. It is hoped that if many people are willing to pay just a little more to know they are purchasing conservation-friendly products, the total financial incentive to producers will be substantial. But the cost to purchasers is larger than it first appears. They must not only be willing to pay more, they must also take the time to understand what they are buying what certification means and which certificates are valid. With the proliferation of certification programs and green labels, that effort is becoming increasingly burdensome. Cynical use of green packaging by advertisers to sell products that have not passed any standards aggravate the problem by making consumers suspicious (Montgomery 1997).

Several important criteria for effectiveness emerged from our evaluation of incentive programs for private landowners. Incentive programs:

- Must meet broad conservation needs. This requires agreement on the definition of terms and needs.
- Must be cost-effective, given the difficulty of securing funds for natural-resource programs. The benefits must justify the investment, especially if public funds are involved.
- Should be easy to understand, administer, and implement. Streamlining and simplicity are essential. Incentive options requiring new legislation may not meet the test of expediency. Many existing incentive programs are underutilized because of their complexity.
- Must be acceptable to landowners. If the goals of the program are not supported by the people who need to make changes in management, the changes probably will not take place. If the incentives do not match people s needs, they will not be used.
- Should be flexible. Landowner needs vary, so administrators should have the discretion to provide different kinds of assistance under different circumstances. More people will participate if their needs are being met.

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SECTION TWO Part II

Conservation Incentives continued

MOST PROMISING INCENTIVES

The following discussion seeks to select ideas that meet the criteria for effective incentive programs, discussed above.

Statewide and Regional Stewardship Councils

Although may individual conservation efforts are under way, coordination and leadership are often lacking. Coordination needs on a state-by-state basis can be addressed through the creation of stewardship councils. Their responsibility in general would be to address natural-resource issues with an emphasis on facilitating cooperative, public/private partnerships for conservation that do not require new regulation.

The councils could be either publicly or privately organized and funded. However, some formal linkage to government programs may be needed to accomplish desired results. The councils could be appointed by governors, authorized by state legislatures, or established informally by resource agencies and private organizations.

Stewardship councils could be composed of prominent citizens with interest and expertise in economics and conservation. They should be relatively independent with small administrative staffs and, initially at least, no regulatory authority. Their purpose would be to facilitate the development of a vision for the state's natural resources over the long term. The councils would address fundamental questions that cut across agency boundaries and various economic sectors: financing conservation, managing information, encouraging cooperation, integrating land-use planning activities, and generally streamlining government to produce better results at lower cost with reduced conflict. The councils would need to address issues under state, federal, local, and private jurisdiction. Above all, their role would be one of providing leadership, inspiration, and strategic vision to the people of each state, not just responding to brush fires. Councils should remain in place until their missions are accomplished.

Regional councils could also be established within states or across state boundaries. Their purpose would be to provide assistance and coordination to local planners, watershed councils, private landowners, and resource agencies as well as to serve as a liaison to the statewide council(s) and to help implement its recommendations. A small staff for each council could collect and distribute relevant information. Forums and workshops could be organized periodically to facilitate communication and education.

The stewardship councils could play an important role in the establishment and delivery of incentive programs to landowners and agency personnel. The statewide councils might focus on policy and tax-reform issues that affect everyone and help establish some statewide priorities. They might also establish overall guidelines under which regional councils operate. The delivery of services and technical assistance would be handled by the regional councils.

Although some concern may be expressed about creating additional layers of resource-management decision-making, the stewardship councils would tackle issues that can only be addressed at a broader scale than watershed councils and local government typically consider. For example, decisions concerning water management, migrating wildlife, and transportation must take into consideration larger landscape areas. However, a review of existing entities should be undertaken periodically to avoid redundancy and waste. In some cases, it might make sense to eliminate existing entities whose missions are no longer appropriate for the changing needs of the area under consideration. In other cases, a successful stewardship council might accomplish its goals after several years and be terminated.

Watershed Councils, Commissions, and Associations

All over the country, watershed councils in various forms and with various purposes have emerged as new institutions to facilitate locally place-based ecosystem conservation. The meaning of the term "watershed council" varies regionally, however.

In the East, they are most often private, nonprofit river and watershed protection associations, sometimes with paid staff who work to educate and advocate for broad-based river protection and restoration. Funding for these groups begins with their members and individual donors, grants from private foundations, business contributions, and occasional government grant programs. Many have decades of commitment to watershed management/ecosystem protection for multi-state watersheds, like the Housatonic Valley Association (founded in the 1940s), Connecticut River Watershed Council (founded in the 1950s), Nashua River Watershed Association (founded in the 1960s), and the Merrimack River Watershed Council (founded in the 1970s). Watershed protection efforts vary tremendously in scope and size. The Westport River Watershed Alliance covers just a 100-square mile area, in contrast to the Connecticut River Watershed Council that covers 12,000 square miles. The largest is the Mississippi River Basin Alliance, which involves 23 states.

In the West, watershed councils tend not to be private nonprofits like their eastern counterparts. Instead, they are usually multi-stakeholder organizations with diverse governing boards that can be composed of environmental activists, ranchers, farmers, business interests, and representatives from federal, state, and local resource agencies. They generally operate under a consensus-based, decision-making model that requires full unanimity on most decisions. They are often highly dependent on government funding or certification for funding and/or staff assistance.

For the Sake of the Salmon is a quasi-governmental agency that seeks to protect Pacific salmon along the entire West Coast. It supports noncontroversial watershed council efforts in a three-state region to enhance and restore salmon streams. The governing board consists of representatives of the governors of California, Oregon, and Washington as well as representatives from timber, agriculture, commercial and sport fishing industries, conservation groups, power companies, the Northwest Indian Fisheries Commission, and various federal resource agencies. Funding comes from various federal agencies and the three participating states.

Whether based on the eastern nonprofit model or the western multi-stakeholder model, watershed councils are faced with numerous challenges. They vary widely in composition, staffing, level of technical expertise, and experience in collaborative decision-making. Few have regulatory authority. Many suffer from a lack of secure funding, which inhibits long-term planning. Most observers agree that the probability of success for watershed councils is enhanced by skilled facilitation; motivated participants, high-quality accessible information, and some level of technical support. Where they are well-organized, with clear missions and effective staff and technical support, watershed councils provide powerful incentives to landowners by coordinating information on funding programs, sharing technical information, and exerting subtle or not-so-subtle peer pressure to protect and restore watersheds. With encouragement and assistance, watershed councils can continue to play a major role in biodiversity conservation efforts.

Stewardship Certification

Stewardship certification is a means of recognizing the land-management operations of various landowners according to established criteria. Some have proposed it as a way to provide marketplace advantages and other benefits to companies and landowners who apply best management practices. The concept of stewardship certification offers significant potential as a tool for conserving biodiversity. It is applicable to many different sectors and activities, can be implemented without new legislation and without the infusion of major public funding, is voluntary, and recognizes good stewardship.

Major concerns include the complexity of certification systems, widespread confusion about labeling and what it means, difficulty in setting standards and awarding benefits, expense of implementation, and the need for extensive training and education of consumers and product providers.

The success of certification programs may depend on the ability of consumers to identify certified products and determine what labels really mean. The proliferation of different programs may overwhelm the public and lead to widespread skepticism of what may be perceived as yet another meaningless advertising ploy (Montgomery 1997).

Although a number of certification efforts are already under way, an umbrella program with a broader focus than existing ones could address a larger group of participants, enhance the overall credibility of the programs, and bring order to an often confusing situation.

Certification teams could be composed of technical experts, affected industry representatives, resource- agency staff, and conservationists. Final approval could rest with the state or a neutral third party. All landowners would be eligible, certified by category. Other businesses with significant impacts to biodiversity also could be included.

Public agencies could be eligible for certification. While the market benefits may not be as clear for agencies as for private companies, certification would allow governments to set an example of good stewardship for all managers, test the application of standards, and facilitate the training of certifying organizations and land managers. Several categories of certification may be required for lands with different uses - recreation lands, refuges, wilderness areas, timber lands, and rangelands all require different management approaches and different certification standards.

Certification would be based on general stewardship principles, with flexibility for local conditions. Many overall stewardship guidelines already have been developed and can be improved and refined over time.

Site plans consistent with watershed/basin management plans would be given a higher rating to encourage landscape-level planning. Stewardship certification should be undertaken in the context of other activities and linked to planning at several scales. Long-term site management plans are necessary to provide detailed information about how biodiversity will be conserved on the ground. Most actions, like riparian restoration, will not occur without the cooperation of public and private landowners.

Certified companies could use their status to promote their products and services through special labeling and additional information to consumers. Certified landowners could be eligible for other incentive programs. Certification could lead to alternative compliance benefits or expedited permitting. As long as environmental goals are met, selected exemptions to regulatory requirements could be granted by state and federal agencies. Tax and subsidy benefits also could be linked to certification. For example, a certified woodlot or farm could be exempt from estate taxes as long as heirs agree to manage the property according to a stewardship plan or agree to develop one within a specified time.

Adaptive management techniques could be required for certification to accommodate improvements in management techniques over time. Flexibility will be needed, especially in the early stages as programs are established.

Certification fees could help support the program, but they should not be so expensive as to discourage participation.

Steps could be established to allow credit for initiating improved stewardship programs that have not yet met the highest standards. As management changes are implemented, additional credit could be awarded to encourage continued improvement. Training for managers and certification of technicians could be offered by various public and private entities.

New programs should acknowledge existing efforts as long as they are legitimate, with an eye toward avoiding additional competition and duplication of effort.

Tax Reform

Without necessarily intending to do so, some tax structures at all levels of government can discourage private landowners from conserving biodiversity. Fortunately, policies are beginning to shift as lawmakers recognize the value of providing incentives for conservation. For example, federal estate taxes often force unnecessary harvests, subdivision, or sale of family-owned farms and forests. Tax bills of up to 55 percent of the value of the land can create insurmountable financial hardships for people inheriting property, including small businesses. Virtually every forum on conservation incentives has highlighted this problem and recommended that Congress address it (Good 1996). Although federal tax reform legislation approved in 1997 did increase the amount exempt from inheritance taxes, no explicit connection between conservation and estate tax relief has been made. Many policy options exist. Tax relief could be offered to landowners in high priority areas, on lands providing habitat for endangered species, on land managed according to approved conservation plans, or on any land regardless of its biodiversity value to prevent it from being developed.

The ability to deduct resource restoration costs at the time expenses are incurred would be beneficial to forest landowners. At present, individuals and timber companies that restore harvested lands cannot receive tax benefits until they harvest the restored lands, which can be many years in the future. In addition to inhibiting investment in the land, this policy tends to discourage longer cutting rotations, an important element of sustainable forestry.

Riparian tax incentive laws hold much promise, if properly implemented. One was recently reauthorized in Oregon.

Although its goals are laudable, it has not been widely used to restore riparian habitat, since property taxes on agricultural lands are already so low that the financial incentive has not been great enough to stimulate much interest. Amending the law to allow landowners to receive credit against their income tax for investments and lost revenue might enhance the effectiveness of the program. Expanding it to lands within the urban growth boundaries could provide substantial tax benefits to urban landowners.

Better Information for Conservation Planning

One of the most powerful incentives for improved land management and stewardship is better and more accessible information. Improved management of resource information and cooperative planning are often cited as critical to enhanced stewardship of natural resources. These factors include more consistent methods for monitoring the distribution and health of selected environmental indicators, more organized approaches to managing and distributing information, and more user-friendly materials focused on specific users. The efficient application of information will require improved coordination among planning jurisdictions (local, state, federal, watershed, or basin planning), which may provide more regulatory certainty to landowners.

One-stop shopping for natural-resource information is often cited by private landowners as an important part of the solution to natural-resource-management problems. For the Sake of the Salmon has proposed that multi-agency teams be created to assist landowners in obtaining incentive payments and other benefits from public and private organizations (For the Sake of the Salmon 1997). Federal legislation has been proposed that would streamline the federal grant application, administration, and reporting process for state, local, and tribal organizations and for nonprofit organizations (Glenn 1997).

Although a worthy goal, one-stop shopping is not easily accomplished. Existing programs have evolved within administering agencies and organizations, each with its own mission, and consolidation is not any one person or agency's responsibility. Turf battles often result from attempts to integrate programs. Just tracking the programs is difficult, since they change constantly. However, as a starting point, a site on the World Wide Web could be established to assist people in finding programs to meet their needs. Staff would be needed to keep the information up to date and to help people without Internet access to find the appropriate information. The Web site could list government incentive programs, private organizations providing assistance, educational opportunities, and other resource databases.

Several means can be used to implement one-stop shopping concepts for the delivery of stewardship incentives. Federal legislation might be needed to establish a pilot area in which to test new, streamlined mechanisms. The pilot area should be large enough to contain a variety of land uses, ownerships, habitat areas, and ecological processes. An overall conservation strategy (for a major river basin, state, or ecoregion) could be the starting point. The strategy should include measurable goals, specific action steps, and a user-friendly monitoring scheme to track progress in implementing the plan. The plan would identify priority areas for restoration and identify groups of landowners who express a willingness to participate in the pilot effort. Public funds that otherwise might have been channeled through individual agencies for narrow purposes could be pooled and efficiently allocated to priority areas. Bureaucratic application and reporting requirements could be waived for participating landowners and managers.

The streamlined incentive delivery program could be administered by stewardship councils, described previously. Key elements in the program would include appropriately trained personnel assigned to the task of collecting, updating, and disseminating information about available incentives, enthusiastic participation by agencies and private organizations, motivated landowners and managers, and adequate funding.

Ultimately, information on conservation incentives might be maintained at the national level by a federal agency or private organization. A user could access a site on the World Wide Web via the Internet to obtain information about federal, state, or private incentive programs in any geographic area. Personal assistance could be provided at the local level.

Technical assistance and education are essential to good stewardship. A more organized, coordinated approach to resource management could improve results and reach additional landowners. Many state and federal resource agencies and private groups provide technical assistance. A higher priority needs to be placed on these efforts within existing agency and organizational budgets. Extension agents can be used to help landowners directly and to train others to provide assistance, assuming that agents consider conservation a high priority. Stewardship councils could help facilitate the transfer of this information to managers.

A number of barriers inhibit effective communication between scientists, policy makers, and the public. Several recommendations have been offered to help reduce these barriers and support informed resource-management decision

making. For example, the institutional evaluation of scientists typically emphasizes success in peer-reviewed publishing (Talbot 1997). If the evaluation process for university and government scientists were revised to give equal weight to researchers who translate their findings to broader audiences, then communication between scientists, policy makers, and the public would be greatly facilitated. Scientists whose work is funded with public funds should be required to write a brief summary of their findings and their relevance, if any, to public policy, including a discussion highlighting potential management implications and applications.

Another way to begin building the bridge between science, policy, and the public is for scientists from various organizations to participate directly in resource working groups (Svejcar 1996). Working groups typically include watershed councils and other collaborative decision-making entities at many scales - from local to regional to national.

Finally, institutions need to encourage participatory science, in which landowners and land managers jointly formulate research questions and then help design and implement new strategies to enhance production while protecting biodiversity values (Bird *et al.* 1995).

A greater percentage of government research funding should be allocated to projects supporting sustainable natural-resource management. In recent years, less than 1 percent of the Agricultural Research Service budget was spent on researching sustainable agriculture. Not surprisingly, farmers pursuing sustainable agriculture tend not to rely on academic institutions and government agencies for information (Bird *et al.*1995). Within the U.S. Department of Agriculture, priority is given to research benefiting conventional agriculture, with an emphasis on increasing productivity. More research is needed to determine how to manage farms sustainably, how to implement ecosystem management (Svejcar 1997), and how to manage low-impact specialty products such as flowers, landscaping materials, native mushrooms, meadowfoam, etc. (McAllister 1996). More consumer education is needed to increase interest in products grown sustainably.

Regulatory Relief

Regulatory relief is desired by many land-owners and could produce substantial benefits at a low cost to the public. Alternative compliance is a form of regulatory relief that generally focuses on goals and not the specific actions taken to achieve the goals. For example, under a bill passed by the 1997 Oregon State Legislature, forest landowners with approved stewardship plans may harvest timber as specified by the plan without first obtaining individual harvest permits from the State Department of Forestry. The same concept could apply to agricultural activities, although regulatory authority over agricultural activities is limited. Some farmers are seeking certification to improve product sales and perhaps avoid strict regulation.

Even ecologically beneficial restoration and habitat-enhancement projects can be halted or delayed because of regulatory processes. For example, according to the McKenzie Watershed Council in Oregon, a fill and removal permit, water storage permit, and a county restoration permit may all be required before a five-acre restoration project can begin. Private landowners can be forced to spend $3,000 to $5,000 before they break ground (Lane Council of Governments 1996).

"Green planning," a new performance-based approach to managing environmental issues, has been used successfully in the Netherlands and New Zealand. Green planning engages each economic sector in developing specific targets - for example, to reduce pollution. Each sector determines the most expeditious manner by which to meet the target. Those participating in the new process are relieved of their responsibilities to comply with more prescriptive regulations, as long as their environmental programs remain on track. Green planning could be addressed by statewide stewardship councils, described previously.

Mitigation Banking

Both public and private parties that carry out activities resulting in the loss of significant natural-resource values often are required to mitigate or compensate for that loss. For example, under the federal Clean Water Act, landowners or developers are generally required to restore or create new wetland habitat as a permit condition for development activities that adversely affect existing wetlands. Under this program, the primary requirement that mitigation be on-site and in-kind has often confined mitigation projects to the immediate area in which the loss occurred, regardless of the relative ecological or recreational value of that area on a regional scale.

Mitigation banking is a mechanism that allows those who are required to mitigate for resource impacts to do so through the purchase of "credits" from a pre-approved mitigation bank. Mitigation banks may be land-based in nature (i.e., sites at which restoration or creation of habitat has already occurred), or they may consist of an account established by, or for, the

permitting agencies, the funds from which are used for acquisition and/or habitat development at a later date. In either case, the concept is based on the premise that mitigation is applied toward larger habitat projects that provide greater collective ecological benefits.

Mitigation banks consisting of an account could be established by each state or region. Money for the account could come from development fees. Funds could be used for land acquisition, easements, or incentive payments to assist landowners in highest priority conservation areas. A similar idea has been proposed at the federal level - the creation of an endangered habitat "superfund" linked to habitat conservation plans. Federal agencies often establish mitigation requirements as a condition of approval for the plans. A portion of the mitigation fees could be deposited in the fund. Revenue could be used for land acquisition, for the implementation of plan amendments that may be required if additional species are listed after the plan is approved, or for monitoring the effectiveness of the plans over time (Margolis 1997).

Mitigation banking is not a new concept. It has been applied in various parts of the country for nearly two decades. However, many of its past applications have been too narrowly focused and lacking in their ability to guarantee habitat protection over the long-term. Recent federal guidelines dealing with the establishment of wetland mitigation banks provide a more comprehensive approach to banking than in the past (United States Army Corps of Engineers November 28, 1995).

While most mitigation banking efforts in the United States have been focused on wetland habitats, the concept can be applied in terrestrial habitats as well, especially as a method for helping to implement regional or landscape-level conservation plans. For example, in southern California the establishment of several coastal sage scrub banks is being used as a tool for implementing the comprehensive Natural Communities Conservation Planning Program in that region.

For mitigation banking to reach its full potential as a conservation tool, federal and state agencies requiring mitigation for natural-resource impacts should reevaluate their existing mitigation policies and should consider mitigation banking as a viable tool for implementing regional conservation planning programs (Smith, K. 1998).

Direct Financial Assistance

A federal biodiversity trust fund could give landowners and managers incentives to protect rare species and endangered ecosystems. The fund would be created through private donations and by tapping 10 percent of all public land-use fees. Funds could be used to purchase land, establish easements, implement wildlife-friendly management practices, and help support state heritage programs (O'Toole 1994). The money could be awarded through a grant process or allocated to resource agencies to spend on priority programs. Additional revenue could be derived from private sources, focusing on activities that render land impermeable, such as a tax on paving, or a real estate transfer fee (O'Toole 1997).

States could create a substantial dedicated investment fund to finance conservation projects. Competitive grants could be submitted to a board that would allocate funding to projects meeting established criteria.

The creation of an insurance fund to compensate landowners who take risks by experimenting with new management techniques could encourage greater participation in new programs (Willamette River Basin Task Force 1997).

Another proposal is to encourage people to identify federal subsidies that damage biodiversity. Proposals to kill the subsidies could be submitted to a "budget squad" with the authority to kill the subsidies and reallocate a share of the funds to conservation programs unless Congress acts to sustain the subsidy (O'Toole 1997).

Conservation easements are an important nonregulatory tool. They can be sold at full market value, donated, or sold at reduced prices, depending on the financial situation and management goals of the landowner and the resources available to the purchaser. Terms of the agreement can vary in the level of restriction placed on management activities. The Forest Service Legacy Program provides funds for conservation easements on working forest lands (Reid 1997).

Cost sharing for restoration is already offered by many agencies and private organizations but has potential for expansion. Generally, if the landowner provides the labor, the agency or organization provides materials, plants, and other items. In some cases, volunteer labor can be used to reduce direct costs further. A greater investment in existing cost-sharing programs and a stronger emphasis on biodiversity (i.e., use of native plants and efforts to control invasive exotics) could produce substantial benefits. Improving the supply of native plants and making them available at reasonable prices is important.

Alternative Crop Planting

Alternative crops can be promoted in some areas to help conserve biodiversity. For example, on farmlands where plowing next to the river is causing erosion, water-quality problems, and loss of riparian habitat, hybrid cottonwoods can be planted and harvested periodically to generate income. Alternative forest products also offer potential opportunities consistent with sustainable forestry. In the Pacific Northwest, special forest products (such as for medicinal, floral, and food uses) account for more than $200 million in revenue annually (Molina et al. 1997).

Gourmet mushrooms, which require less intensive farming techniques, also could be grown in riparian areas. Where water shortages exist, native grasses and other plants with reduced water requirements could replace thirstier varieties. Demonstration projects highlighting these possibilities could stimulate additional interest. In some cases, marketing assistance could stimulate sales and generate interest among producers.

Examining Public Expenditures That Harm Wildlife Habitat

Many programs financed with public funds, some of them decades old, may unintentionally harm wildlife or wildlife habitat. In general, they were established to encourage economic development at a time when environmental concerns were not as prominent as they are now. A thorough review of these and other federal programs could help to determine the need to redirect public funds into programs with clearer public and environmental benefits.

Friends of the Earth and Taxpayers for Common Sense (1997) provide a few examples of programs that have been severely criticized for their adverse impacts on the environment. For example, the General Mining Law of 1872 permits anyone to enter open public lands to explore for hardrock minerals such as gold, silver, lead, copper, and zinc. Anyone filing a claim has an automatic right to extract discovered minerals. More than 330,000 claims on federal lands operate under this law. Each year, more than $2 billion worth of minerals are taken from public lands with no royalties paid to the federal treasury. Mining companies can also purchase patents for $5 per acre or less, then extract the minerals for a hefty profit. Changes to this law should address royalty payments, protect sensitive areas from damage, and establish requirements for complete restoration after mining.

Agricultural subsidies have been in place for decades. They were initially intended to support farm income, maintain prices, and control the production of basic commodities. According to the General Accounting Office, the government spends $1.5 billion on the cotton program alone. Recent studies show that base-acreage provisions of agricultural subsidy programs contribute significantly to farmers - reliance on agrichemicals. Linking participation in agricultural subsidy programs to the application of best management practices would generate significant environmental benefits.

Road construction for timber harvest on public lands has traditionally been financed with public funds. More than 370,000 miles of road have been built on national forest lands. These roads fragment wildlife habitat, facilitate access into remote areas, disrupt hydrologic processes, and damage aquatic habitat. Federal agencies should avoid constructing roads in undisturbed areas and continue decommissioning unnecessary roads.

Federal water projects intended to control flooding can cause substantial environmental damage. The presence of water-control structures such as dams, dikes, and levees encourages people to develop floodplain areas, thereby restricting the natural flow of rivers and destroying important habitat for fish and wildlife. Federal investments in flood management should be focused on projects that discourage floodplain development and facilitate the restoration of natural processes while protecting developed areas from damage caused by flooding.

Some irrigation projects encourage the inefficient use of water, encouraging production of water-intensive crops in arid regions. In these regions, loss of natural river flows has destroyed wetlands and harmed fish and wildlife populations. Irrigation also tends to foster agricultural production on marginal lands, which often requires excessive use of chemicals. Establishing higher prices for irrigation water and/or linking water delivery to the implementation of conservation plans could help encourage more appropriate use of water.

The federal Animal Damage Control Act of 1931 was established by Congress to eradicate, suppress, and control predators deemed harmful to human activities. In the past, the program focused on animals that are now in jeopardy, including grizzly bears and wolves. The program should be examined to determine if federal funds are being expended on methods that are the least likely to cause harm to wildlife.

National Stewardship Initiatives:
Conservation Strategies for U.S. Land Owners

by Sara Vickerman

SECTION THREE Part I

Major Land Uses

The preponderance of the nation's landscape is used not for protection of natural ecosystems and biological diversity but for various forms of development, primarily agriculture and forestry. Some areas are subject to intense development pressure to accommodate a rapidly expanding population.

The following is a discussion of major land uses in the United States relative to biodiversity conservation. Since agriculture and forestry are the most extensive uses and also have the greatest potential to support biodiversity goals, they are emphasized in the report. Most lands, including parks and refuges, support some elements of biodiversity but may harm other elements. Consequently, the positive and negative impacts for each land use are discussed, followed by management recommendations and incentive options. The primary purpose of this section is to explain the range of land-management improvements necessary to meet biodiversity goals.

Since resources for financing incentive programs are limited, we suggest that land agencies focus their efforts on areas with high ecological importance and seek to make biodiversity-friendly management practices more economical for landowners. Although intensive land development, agriculture, and forestry can support biodiversity goals overall by reducing pressure on wildlands, incentives to support intensive management activities are not recommended, since the economic return from the lands should be sufficient without public subsidies.

Since good stewardship has so many common elements regardless of the specific land use, a certain amount of redundancy is inevitable when addressing management strategies. An effort has been made to avoid repeating recommendations that are broadly applicable to each land use.

AGRICULTURAL LANDS

Agriculture is a relatively small part of the U.S. economy, accounting for approximately 2 percent of the gross domestic product, but it is extremely important for wildlife and biodiversity concerns as it affects about 42 percent of the total U.S. land base.

The number of farms has declined at a faster rate than the amount of land in farms. The number of farms declined annually by about 1 percent from 1986 through 1996 except for a slight increase in 1995 due in part to a change in definition (a farm is now defined as any establishment from which $1,000 or more of agricultural products is or normally would be sold yearly). By 1996, the United States had just over 2 million farms. Land in farms continues to decline slowly. The total of 968 million acres in 1996 is down 0.4 percent from a year earlier and down 3.7 percent from 1986. Land in farms has declined every year since reaching its peak at 1.2 billion acres in 1954 (total land area of the United States is about 2.3 billion acres) (United States Department of Agriculture 1997).

Agricultural lands provide important wildlife habitat, open space, and aesthetic qualities. Farmland is under increasing development pressure. As urban and suburban areas encroach on agricultural lands, conflicts have intensified over many issues, such as pesticide use, dust, noise, odor, and habitat modification.

The challenge is for agriculture to accommodate environmental goals and for conservationists to accommodate agriculture (Tippens 1997). However, views concerning sustainability and how it can be accomplished are widely divergent. Some groups advocate such measures as reduced chemical and fertilizer use and alternative cropping (Bird et al. 1995). In contrast, supporters of high-yield methods using substantial chemical inputs argue that intensely farming the most

productive lands is necessary to meet the world's growing demand for agricultural products without destroying wildlife habitat (Hudson Institute 1997).

The following section addresses a broad range of agricultural activities that contribute to and affect biodiversity. The groupings were selected to distinguish between different farming practices. Many common goals and stewardship principles, however, apply broadly to any agricultural activity, and a wide range of existing and potential incentives are applicable. General statements appear in the beginning of the section, followed by a discussion of more specific recommendations as they apply to certain types of agricultural activities.

Contribution of Agricultural Lands to Biodiversity

Many farmers have close cultural, spiritual, and economic ties to the land and understand the importance of maintaining its productivity. They also have an intimate familiarity with native wildlife and plants and enjoy the benefits of healthy and diverse ecosystems.

Many agricultural practices are compatible with wildlife needs. For example, well-managed grazing operations leave substantial native vegetation in place for a variety of species and need not disrupt ecological processes. In many areas across the country, large mammals such as deer and elk find irrigated pastures attractive for feeding. Migratory waterfowl enjoy farm ponds, flooded fields, and unharvested grains left during winter months. Songbirds frequent orchards and vineyards throughout the year. Flowering crops provide habitat for birds and pollinating insects. Raptors are often seen hunting rodents on farm fields.

Beyond the obvious, however, agricultural lands are important to biodiversity for additional reasons. The most productive and biologically diverse lands in America were settled and converted to agricultural uses long before public lands were set aside for conservation. Most of these lands are in private ownership and possess the abundant water, rich soils, and gentle terrain important to agriculture and to native biodiversity. Few of these lands are managed primarily for biodiversity values.

Agricultural lands also provide an important buffer - a transition zone - between wild and urban areas. Most agricultural lands have the potential to be restored to more natural conditions, unlike more intensively developed urban and industrial areas where natural habitat has been irrevocably altered.

Lands now managed to produce food and fiber need not be restored to natural conditions and managed exclusively for biodiversity values. Rather, agricultural areas are essential to the overall conservation of biodiversity and will become more important as human population expands. The purpose of this section is to identify management practices that might be adopted or modified to improve the contribution of agricultural lands to biodiversity and to identify motivating factors and potential incentives for farmers to meet biodiversity goals.

Biodiversity Issues and Impacts

Many agricultural activities can harm native plants, animals, and ecosystems. The nature and extent of these activities vary considerably from one farm to the next and from one region to the next. Some impacts are site-specific, while others are cumulative and can be evaluated only over time and across large landscapes. While the extent and significance of these effects is debated, some generally recognized impacts associated with agricultural practices include:

- Widespread conversion of native habitats to domestic crops and the associated homogenization of landscape composition and structure. Widespread conversion of biologically rich wetland habitats to agricultural uses is of particular concern (Falk 1992).
- Reduction in water quality and quantity, which can thwart efforts to support plants and animals, especially fish. These impacts result from direct water withdrawal for irrigation, water returns with high temperatures, sediment loads, chemical contaminants, degradation of fish rearing areas, and erosion of stream banks (National Academy of Sciences 1982).
- Inappropriate use of pesticides to control insects and weeds, which has serious consequences for wildlife, soils, and water quality (Bird et al. 1995).
- Removal of riparian vegetation by livestock or through cultivation, which can reduce or degrade riparian habitat for aquatic and terrestrial wildlife (National Academy of Sciences 1982).
- Deterioration of soils from compaction and erosion, which can adversely affect the long-term productivity of the

land and hydrology of watersheds (National Academy of Sciences 1982).

- Spread of invasive exotic plants and insects, which can threaten both agricultural crops and natural communities and require costly control efforts (Bureau of Land Management 1996c).
- Use of indiscriminate animal-damage-control methods, which can inadvertently kill wildlife beyond the targeted species, seriously affecting local populations (Noss and Cooperrider 1994).

Stewardship Principles and Management Recommendations

Although management practices and recommendations vary considerably from one agricultural operation to the next, some principles can be applied to most agricultural lands to improve land stewardship and enhance biodiversity:

Location of farmland relative to other land uses is a critical factor. Many state land-use laws are designed to protect farmland, but they have not been fully applied to conserve areas of ecological sensitivity within the agricultural landscape.

Conserving patches and strips of native habitat, including native shelter belts and hedgerows, provides food and shelter for wildlife and requires little area and maintenance. The protection of special areas such as bat caves, rock piles, and woodlands within farmed areas can provide important wildlife habitat. Brush piles provide cover for many species. Unfarmed areas can also provide important habitat (Clark and Rollins 1996).

Proper construction and maintenance of culverts, dams, bridges, and other in-stream structures helps to ensure fish passage in agricultural waterways. Screening water diversions helps to prevent fish stranding and other forms of mortality.

Maintaining and protecting riparian and wetland areas is highly effective at reducing erosion and blocking chemical flows. Establishing vegetation next to ponds, sloughs, and ditches also provides habitat. Where erosive stream-bank damage is already advanced, restoration techniques to stabilize stream banks and reduce in-stream channelization are often effective. Shallow, wet areas can be provided for nesting waterfowl in spring and summer. Maintaining fresh water in some ditches year-round will benefit some species. Maintaining connectivity between riparian and upland habitats will reduce wildlife mortality (Clark and Rollins 1996).

Allowing natural regeneration from small natural disturbances, such as leaving fallen trees in streams or ponds, enhances natural vegetative diversity. Promptly removing invasive weeds before they become established, purchasing feed and seed certified for vegetal purity, and washing vehicles operated in weed infested areas are some important steps in controlling the spread of exotics (Bureau of Land Management 1996c).

Using integrated pest management - the application of biological, cultural, mechanical, and chemical methods - to combat pest problems can reduce damage to biodiversity (Pokorny 1997). Preventive methods should be used where possible. For example, covering ponds with netting can prevent birds from eating fish. When lethal control is required, methods selected for target species must avoid severe impacts to other local wildlife populations (Noss and Cooperrider 1994).

Alternative cropping can be used to address many of the issues cited above. Crops with natural resistance to pests, lower water requirements, and other desirable attributes can sometimes be substituted for agricultural products and practices associated with intensive land management. Leaving some fields fallow or planting nitrogen-fixing cover crops can provide wildlife food and habitat while enriching the soil (Clark and Rollins 1996). Use of intercropping (rows of trees with grain or seed crops in between) can conserve water, provide protection from wind, improve wildlife habitat, conserve soil, and reduce chemical use (McAllister 1996).

Water withdrawals that emphasize proper scheduling (avoiding times of high wind and temperatures), adequate pressure, even application, close monitoring, and leak-free systems can substantially reduce water uses, leaving more water for in-stream uses. Recirculation and re-use of water also help meet conservation goals (Trimmer 1994). Selecting crops with reduced watering requirements is important in arid areas.

Aquatic organisms have specific needs with respect to water quality and temperature. Maintaining vegetative cover in the watershed is the most cost-effective approach for stabilizing water temperature and quality. Composting manure has multiple benefits for soil fertility and water quality (Bird et al. 1995).

Conservation tillage, involving no-till and minimum-till methods, effectively reduces soil loss and helps retain surface residue. Cover cropping and crop rotation also stabilize and maintain healthy soil and encourage beneficial insects (Pacific

Northwest Extension 1986).

Biological controls reduce the need for herbicide and pesticide inputs by helping native plant and insect species to out-compete harmful weeds and pests. Specific methods vary, but lands managed with the maintenance of plant and animal diversity in mind are less susceptible to pest and weed outbreaks. Legume cover crops fix nitrogen naturally and reduce the need for chemical fertilizer inputs (Bird et al. 1995).

Recycled materials (food wastes, containers, construction materials, etc.) do not end up in a landfill and the demand on virgin resources is reduced. Efficient energy use, particularly of fossil fuels in agricultural operations, contributes to broad biodiversity goals by limiting air-borne pollutants and diminishing impacts associated with oil and gas exploration.

Although addressing the issues above will produce environmental benefits, long-term solutions will require more integrated approaches. Interest is increasing in sustainable agriculture (see below), holistic management, coordinated resource management, and permaculture an integrated system of design encompassing not only agriculture, horticulture, architecture and ecology but also land-access strategies and economic systems for small businesses and communities (International Institute for Ecological Agriculture 1997). An important first step in implementing integrated approaches is to develop management plans.

Sustainable Agriculture

Sustainable agriculture is a long-term goal, an approach to help farming become more economically viable, environmentally sound, and socially equitable.

Farmers pursuing this approach often rely on several common principles: Increasing biological diversity; recycling nutrients and waste products; protecting and restoring natural resources; accounting for all costs of farming, including long-term and external costs; and employing intensive management. Many mainstream commercial farmers are adopting practices and techniques that support sustainability and often find these cost effective.

In the past 10 years, public sector support for sustainable-agriculture research and education has been greatly expanded through programs such as the U.S. Department of Agriculture s Sustainable Agriculture Research and Education grants. These programs, along with support from private foundations, non-profit organizations, and the innovation of thousands of farmers, have led to substantial change addressing sustainability on the farm in many areas. Existing efforts such as conservation tillage and integrated pest management contribute to sustainable-agriculture goals as well.

A number of steps might encourage more farmers to practice sustainable agriculture. Local markets for specialty products could be developed, along with product identity related to growing practices.

Public sector support for research and extension could be enhanced, in contrast to the current downsizing. More economic studies of farming systems using sustainable approaches would help to quantify the risk to farmers making changes in their production practices.

General recommendations for sustainable agriculture include:

- Use less land for row crops. Put more land in hay, small grains, forage, pasture, woodland, and wetlands and in conservation uses. Strategies focus on farming ecological niches, not just fields, matching crops to slope and soil type.
- Use a greater variety of crops grown in more complex rotations to break weed and disease cycles, protect and build soil, and spread labor requirements over a longer period with less peak needs.
- Provide a variety of higher-quality habitats to encourage and enhance greater wildlife diversity.
- Use cover crops and soil-building crops like legumes, clover, and grass.

- Integrate crops and livestock production with intensively managed grazing and recycling of manure to build soils.
- Implement less-disruptive pest control tactics using integrated pest management. Monitor pest levels and act only when an economic threshold is reached. Use biological controls when available.
- Improve nutrient management to maximize efficiency and minimize nutrient movement to surface water and groundwater. Use soil and plant testing to determine nutrient need. Add nutrients at times of peak crop use. Properly store and apply animal manures, and consider composting manures and other wastes.
- Control soil erosion by increasing the protective cover on the soil surface with practices such as no-till, cover crops, and windbreaks. Apply conservation measures such as contour strip cropping and grass waterways where appropriate.

Source: Granatstein. 1996 and Bird *et al.* 1995

Sustainable Agriculture: An Alternative View

An alternative view of sustainable agriculture is promoted by the Hudson Institute of Indianapolis, Indiana. According to Dennis Avery, director of the Center for Global Food Issues, more research on high-yield agriculture is needed to help combat world hunger, strengthen rural economies, and save the world's wildlands and wildlife species from being needlessly plowed down to make more room for low-yield farming.

Avery told a U.S. Senate Committee that increased crop yields during the past 40 years are saving more than 10 million acres of wildlife habitat around the world. The Soil and Water Conservation Society of the United States says that the most sustainable farming ever is being done today using intensive management, including high-powered seeds, chemical fertilizer, pesticides used in integrated pest management, and conservation tillage.

Martin Wistisen, president and CEO of AgriNorthwest and a strong proponent of this view, believes that globally the two greatest threats to sustainable agriculture are soil erosion and the mining of soil nutrients. In his opinion, soil erosion is best controlled though minimum or no-till mechanical farming practices, along with the responsible use of herbicides to kill unwanted weeds. Soil nutrients can be controlled through the responsible use of commercial fertilizers and other chemicals.

Source: Hudson Institute. Spring 1997 and Wistisen 1997.

Existing and Promising Incentives

Research on the effectiveness of incentives for soil conservation has identified several factors that determine whether farmers are likely to participate. These include the time and effort required to establish eligibility, the availability of technical and financial assistance, the compatibility of the promoted practice with present farm operations, and the profitability of the pollution-control investments relative to other investment opportunities. Cost-share programs must significantly offset the farmer's costs of implementing new techniques (Stabinsky et al. 1995). In general, the interaction between economic feasibility and risk determines the likelihood that an ecologically based management system will be adopted or implemented by growers (National Research Council 1996).

The Conservation Reserve Program (CRP) and Wetland Reserve Program (WRP), administered by the U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS), have been in place for many years. Initially, a primary purpose of CRP was to subsidize farm income and conserve soil. Gradually, the program has shifted toward preventing erosion (Delworth 1997). Amendments in 1996 expand the stated purpose to give wildlife the same priority as soil and water conservation (Stewart 1997). The new rules also authorize CRP payments to protect riparian range and pasture lands

(Streif 1997).

The Partners for Wildlife program is administered by the U.S. Fish and Wildlife Service in cooperation with the U.S. Department of Agriculture and other agencies. The focus is on agricultural lands, where the program seeks to restore and enhance ecosystem functions and values within the context of multiple land uses by providing financial and technical assistance to nonfederal landowners. Projects are designed to help protect, restore, and enhance wetlands, riparian systems, and associated uplands. The Service distributes the funds broadly to encourage partnerships and cost-sharing (Smith, M. 1997).

Direct financial assistance to offset costs associated with ecological restoration efforts and to recover income lost to reduced production in areas managed for biodiversity may be the most appealing incentive for some landowners (Streif 1996). Cost sharing for restoration is already provided through a number of agency and private efforts. A more deliberate, strategic, and streamlined process with additional funding could improve biodiversity values in priority areas by increasing participation.

Taxing strategies and other economic incentives for encouraging growers to adopt improved management practices include (Granatstein 1997):

- Surcharges used in association with environmental labels (ecolabels) to raise funds for developing and implementing improved practices in a given sector. For example, in Pennsylvania a dairy initiative would use a surcharge on milk to assist participating dairies in improving manure handling. Some of the surcharge would go to growers already doing a good job (a market reward) and some to others who need money to upgrade facilities.
- The Wisconsin Conservation Credit initiative, which provides property-tax credits to growers following an approved conservation plan.
- A Washington state crop-insurance program that is provided to farmers using pheromones instead of pesticides to control insect damage on an experimental basis, for a limited time.

To the extent that assistance can be provided by nonregulatory agencies, or by individuals within agencies who do not have enforcement responsibilities, landowner acceptance may be improved. However, demand for technical assistance and information about existing incentive programs (e.g., how to apply and participate in broader conservation programs) is not being met (Streif 1996).

Market incentives can be used to encourage the adoption of sustainable agricultural practices. For example, special labeling can alert consumers to items produced using sustainable methods. Assistance with marketing specialty products would encourage more farmers to produce them (Chambers 1997).

The Stewardship Program of the Northwest Food Alliance assists growers in applying the most environmentally sensitive farming practices available that allow them to produce competitively priced, high-quality products. It strives for continual improvement and focuses on integrated plant protection, emphasizing cultural and biological values and use of less disruptive chemicals in multi-crop, whole-farm, pest-management systems (Northwest Food Alliance 1996).

Public recognition and awards for adopting environmentally sensitive techniques can improve agriculture's public image and increase awareness of the role of farming. However, some landowners do not wish to be recognized, and such awards are unlikely to encourage the adoption of new, costly management programs.

Some landowners are concerned that habitat enhancements on private land, especially if they are financed partially with public funds, may require or imply a right of public access. A guarantee that access decisions will be made exclusively by the landowner would encourage broader participation in enhancement programs. However, some landowners may generate revenue through fee access for outdoor recreation (Smith, S. 1996).

The Department of Agriculture could link participation in the agency's farm programs to "integrated farming systems," which focus on supporting agricultural production through pollution prevention and natural-resource conservation (President's Council on Sustainable Development 1996a). Changes to federal legislation in 1996 moved in this direction.

"Alternative compliance" is a concept worth exploring as a way of encouraging participation in stewardship programs. The concept is based on the assumption that environmental goals can be met in many ways and that program flexibility encourages people to use the most cost-effective and innovative methods available. Regula- ions are sometimes narrowly

focused, perceived as too prescriptive, and cause a great deal of unnecessary delay and paperwork. To implement alternative compliance in the agricultural sector, farmers who qualify for stewardship certification and who complete an approved management plan could be exempted from some prescriptive regulations as long as plans are implemented and goals are met.

Stewardship exchange programs could be established and do not necessarily have to be complicated or expensive. For example, Oregon cattleman Fred Otley has proposed that landowners receive preferential access to public resources in exchange for adopting certain management practices on private land (Otley 1996). Willamette Valley landowner John Miller has suggested that farmers who agree to improve habitat by, for example, removing drains in prior converted wetlands be eligible for unreserved water rights to fill resulting water gaps on their lands (Miller 1996).

Banks and other lenders inadvertently encourage the farming of marginal land by calculating the value of agricultural operations based on total acreage. Taking marginal or sensitive lands out of production may actually enhance a farm's overall profitability. Lenders may be willing to adjust this practice if they are informed about the opportunities associated with a different approach (Miller 1996).

States could authorize reduced property-tax rates for landowners in farm and forest zones who have approved habitat plans. Hobby farmers with other primary sources of income may be especially interested in the opportunity.

Landowners could be required to use best management practices to receive farm deferral tax benefits. Hobby farmers are less likely than full-time farmers to use best management practices because they lack interest and/or expertise (Colby 1997). However, since many hobby farmers may engage in agricultural activities primarily because of the tax benefits, they could be required to protect natural resources to qualify for farm deferral tax benefits.

Open-Range Grazing Operations

Open range grazing is a dominant land use outside populated areas in the West. Much of the land is in public ownership, although low-elevation areas and water rights are generally privately owned. Well-managed grazing operations can support vast expanses of native habitat and wildlife.

Rangeland Management Recommendations

Improperly managed livestock grazing and fire suppression have contributed to the expansion of western juniper and invasive exotics, such as cheatgrass and medusa head, into sagebrush grasslands (West 1993) and to the degradation of riparian habitats from associated erosion and ecosystem changes. Alterations to vegetation and species composition have had a profound impact on rangeland ecosystems (Oregon State University Extension Service 1993).

Roads and fencing can impede the movement of native wildlife, especially ungulates, and decrease and fragment available habitat. Water development decreases the abundance of native plants in limited areas and encourages the expansion of grazing into new areas. Disturbed soil is more vulnerable to exotic weed invasions. Chaining, plowing, and seeding reduce richness and diversity of native species, increase vulnerability to invasions by exotic species, and degrade the soil. Predator control decreases native predator populations and disrupts biotic communities (Cooperrider 1996). Fire suppression increases dominance of woody species and reduces herbaceous species and patch density (Svejcar 1996).

Protecting biodiversity on open rangelands does not necessarily mean returning to historical conditions (Tauch et al. 1993). Achieving natural conditions on many rangelands is problematic, given widespread ecological disturbances caused by nature and humans (Sprugel 1991). Realistic and achievable biodiversity management goals should focus on maintaining ecological functions and avoiding harm to native species. Maximizing livestock and wildlife benefits on every acre is not possible, so biodiversity objectives will need to be met on landscape and regional scales (West 1993). A few management recommendations follow:

- Avoid continuous grazing at one site (Cooperrider 1996).
- Strictly control riparian grazing by using corridor fencing, separate pastures, regular herding, and supplemental water, salt, and feed (Chaney et al. 1993).
- Avoid extensive use of in-stream structures, which are expensive and prone to failure (Chaney et al. 1993, Elmore and Beschta 1996).
- Manage western juniper through prescribed burning and cut-and-scatter techniques to restore healthy grasslands

(OSU 1993). Juniper provides many benefits to wildlife, so universal removal is not recommended (Cooperrider 1996 and Belsky 1995). Some researchers recommend controlling juniper on south slopes, since it reduces understory, causes erosion, and shades out native grasses and forbs important to both cattle and wildlife (Svejcar 1996).

- Replace traditional predator-control methods with guard dogs, herding, and selective control aimed at offending animals (Cooperrider 1996). Federal and state animal-damage-control programs could offer free assistance for integrated controls and charge fees for lethal methods.
- Control the spread of invasive exotic weeds such as star-thistle, medusa head, and knapweed by focusing on newly established patches and controlling them immediately (Asher 1994).
- Re-establish native vegetation on rangelands where seed is available and where conditions permit (Cooperrider 1996).
- Consider the condition of the land at a given site and determine whether an alternative class of livestock would have a reduced impact (Cooperrider 1996).
- Use prescribed burning to restore natural fire cycles (Cooperrider 1996, Svejcar 1996).
- Close roads and limit ORV use at critical times (West 1993).
- Plant scattered trees in open areas to benefit wildlife and help distribute cattle (West 1993).
- Monitor regularly, using annual photos, to document riparian and overall rangeland improvement (Elmore 1997).

Rangeland Conservation Incentive Options

Incentives for improved rangeland management include a broad range of approaches, including more coordinated planning and management, improved information about ecosystems, regulatory relief, financial assistance, and market incentives. Most of these options are covered in the introduction. A few incentive options particularly well-suited to grazing operations follow.

Coordinated planning and management could reduce livestock impacts and help to achieve biodiversity goals (West 1993). Coordinated Resource Management (CRM) is essentially a cooperative, holistic approach to land management that represents an approach to decision making that some find appealing. However, it is not supported by some environmental interests that may be excluded from the process (Myron 1997).

In Wheeler County in eastern Oregon, a group of landowners, resource agency personnel and other stakeholders formed a CRM group to develop a plan for the 250,000-acre Bridge Creek Watershed. They used the CRM process to address potentially contentious issues: endangered fish, high water temperatures, invasive exotic weeds, and wildlife depredations. A major land exchange between the federal Bureau of Land Management and private landowners was accomplished as part of the process. The Bridge Creek CRM group has been formally recognized as a watershed council to obtain project funding from the state and other sources (Gibbs 1997).

Wyoming's state-sanctioned CRM groups operate by four cardinal rules:

- Management by consensus.
- Commitment by all participants.
- Broad involvement by all interested parties.
- Group members express needs instead of positions.

In Wyoming's Muddy Creek watershed, a CRM project produced dramatic results. Reintroduced beavers helped slow streamflow. Road closures and culvert installations improved spring runoff. Strategic grazing shortened riparian grasses and left upright stalks ready to trap sediments and rebuild stream banks. Streams narrowed and deepened, leading to more vigorous riparian growth, increased groundwater storage, and improved fish habitat. Perhaps most interestingly, the results also included higher beef production (Van DeWetering 1997).

Holistic management, pioneered by range-management theorist Alan Savory, encourages livestock producers to be stewards of the land, taking a holistic view of the operation and associated human needs. Diverse interests are brought together to establish goals and develop management strategies. According to supporters, successful applications of the technique have produced dramatically improved forage and wildlife habitat (Daggett 1997). The approach has worked for a number of livestock producers, including the producers of Oregon Country Beef. It has recently been expanded to address decision-making in general and it is being promoted through a program at Washington State University (Donovan 1997).

The approach is not without controversy. Savory's approach provides useful tools for planning and goal-setting. However, some in the scientific and environmental communities have questioned Savory's ecological assumptions (Svejcar 1997).

Improved knowledge of ecological processes is often enough to stimulate interest in restoring damaged systems. The National Riparian Initiative, sponsored by the Bureau of Land Management and Forest Service, has conducted popular workshops throughout the West to assist ranchers and other landowners in restoring riparian land along streams (Elmore 1997, Holzman 1997). Additional research on the function of native and exotic rangeland species is needed to determine which are most critical to maintaining soils and ecosystem processes and to help guide management strategies (West 1993).

Green marketing for meat appeals to consumers interested in healthy products and good land stewardship, while improving public relations for ranchers. The competitive advantages that green marketing gives to its products helps to spur ranchers toward principles of sustainable land management and biodiversity (Sustainable Northwest 1997).

Stewardship exchange agreements could be negotiated between private ranchers and federal land managers. Under this approach, ranchers undertaking certain projects with biodiversity benefits (e.g., riparian protection on private lands) would receive special grazing access to public lands (Otley 1996).

Public-land grazing fees also could be linked to stewardship practices. Public lands sustainably used by ranchers could be leased for lower fees. Higher fees would be charged to ranchers who degrade lands, and failure to improve operations could result in lease cancellation. Wayne Elmore, director of the National Riparian Service Team, suggests that grazing fees should be reduced 25 percent when ranchers complete a management plan, 25 percent more when the plan is implemented, and another 25 percent when management goals are achieved (Elmore 1997). Another means for reducing livestock pressure on public lands would be to change federal rules regarding grazing leases so that private parties can purchase the leases strictly for the purpose of retiring the associated Animal Unit Months (Myron 1997). Similarly, rules could be changed to allow the use of public funds to buy and retire leases.

Finally, creating or improving markets for products that result from better land management can help to enhance biodiversity protection. For example, improved harvest techniques for western juniper, used for specialty furniture, desk sets, golf putter heads, and aromatic oils, could provide economic incentives for its selective removal where it harms rangeland ecosystems (Hollon 1997).

National Stewardship Initiatives:
Conservation Strategies for U.S. Land Owners

by Sara Vickerman

SECTION THREE Part II

Major Land Uses continued

FOREST LANDS

According to the U.S. Department of Agriculture, forest land totaled nearly 737 million acres nationwide in 1992. About two-thirds was classified as timberland (commercially productive forest) and the remainder as a combination of productive reserved forest land (timberland withdrawn from timber use by statute or administrative regulation) and other forest land, such as unproductive and urban forest. Much of the forest area serves multiple purposes. For example, nearly a fifth of the acreage is used for livestock grazing, and large areas are available for recreation.

The total forest acreage is divided almost equally between the humid eastern portion of the nation and the western portion, including Alaska. The forest area is particularly large in the Northeast, Appalachia, and Southeast, composing about 60 percent of all land in those regions. Acreages in the West are similarly large but make up a smaller proportion of the total land area (Daugherty 1996).

Contribution of Forest Lands to Biodiversity

Much controversy surrounds the management of U.S. forests for timber. Lumber companies, for example, maintain that even logged forests, if well-managed, can support wildlife and help maintain long-term biodiversity conservation. Elk, for example, flourish in clearcuts, especially those seeded for their benefit with favored plants. House wrens and dusky flycatchers are commonly found in recently logged areas (Boise Cascade 1996).

Although the effects of logging are subject to debate, most experts acknowledge that timber management can cause long-term changes to plant and animal populations, affect the composition of plant communities, and alter major ecological processes. Some foresters, however, have suggested that properly managed commercial forestry operations may have less impact on an ecosystem than other forms of intensive development (Rochelle 1996). They argue that under commercial-forest management, soil and vegetation are disturbed relatively infrequently. They add that forest management often addresses recreational and aesthetic values, thereby moderating deleterious effects.

Nevertheless, logging can bring with it serious ecological perturbations. The widespread conversion of diverse, native forest habitats to plantations devoted to production of a single tree species slated for relatively frequent cutting tends to eliminate habitat for cavity-nesting species, reduces the amount of dead and downed wood that nourishes soils, and opens interior forests to invasive exotic plants, pests, and edge-loving animals. Timber harvest can disturb soil, causing erosion and even landslides. Soil compaction also can reduce site productivity. Disturbance of streams and riparian habitat can damage spawning and rearing habitat for fish. Fire suppression has caused widespread ecological changes and, in some cases, contributed to serious forest health problems, including insect invasions and fuel accumulations, making forests vulnerable to high-intensity fires. Road construction, maintenance, and use tend to fragment habitat and open lands to more intensive recreation, vandalism, and wildlife disturbances.

Although, as mentioned above, clearcuts can benefit elk, forest-management practices must be carefully planned not to focus on one species to the exclusion of all others. Not all species have the same habitat requirements, and management practices benefiting one species might cause adverse impacts on other species. According to an Oregon Forest Resources Institute report, "large mammal herbivory has altered, and continues to alter, the understory in ways that reduce nesting opportunities for some bird species, the regeneration of aspen, and the productivity of large mammals themselves" (Bunnell et al. 1997). The report suggests that no single approach to forest management is sufficient, and "the worst possible approach to maintain vertebrate diversity would be to manage every acre the same way" (Bunnell et al.

1997).

Stewardship Principles and Management Recommendations

Many programs have emerged in recent years to address concerns about forest management. Ecosystem management is now the dominant management paradigm within resource agencies and many major timber companies. Sustainable-forestry programs are promoted by universities, conservation groups, agencies, and industry. In general, the concept of sustainability includes not just sustaining wood production but also the health of all other organisms in and around forests, in addition to human communities, soil, water, and air.

Specific strategies for sustainable development vary by region, by site, and by landowner objective. However, the guidelines included in the discussion below are worth considering when developing any plan to manage forests sustainably.

Planning is critical in forest management and should occur at multiple scales. Conserving biodiversity stand by stand is not sufficient because many impacts are cumulative and must be addressed regionally. Even though management activities such as the creation of forest openings and edge effect may increase the number of species present in a given area, the overall impact that these elements have on biodiversity may be negative if habitat needed by species in jeopardy is modified or destroyed. Some impacts will be positive as well. Regional plans should be based on a landscape-level assessment of the overall pattern and distribution of different habitat types and should provide for connectivity and maintenance of ecological processes (Oregon State University Extension Service March 1996b).

The natural diversity of plants and animals should be maintained. An important goal of many conservationists is to manage for viable, self-sustaining populations of native species region-wide to the extent possible within the context of forest management. The needs of every species do not have to be accommodated on every site, so context is important. Use of native plants in reforestation will enhance habitat value for native animals.

Reforesting harvested sites is critical to forest health. Failure to replace cut trees can result in the invasion of aggressive, exotic plant species. Reforesting improves commercial value while helping to preserve or restore biodiversity. Reforesting with a diversity of tree species native to the area is preferable to establishing a monoculture.

Beneficial birds and insects should be protected to help control insect pests. For example, birds and ants combined can significantly reduce spruce budworms on individual trees, and at least 30 bird species are high potential predators of tussock moths. When using heavy equipment, work around ant colonies, which can last up to 20 years and house 30,000 or more ants (Logan and Fletcher 1996).

Various seral stages should be maintained across regionally. Since different species require forest habitat in different successional stages, species diversity will be maintained if all seral stages are conserved in appropriate patch sizes and configuration (assuming that scientists can provide meaningful and practical guidance to help determine proper size and configuration). The location of forests in different stages will change over time with or without human interference, so long-term, broad-scale planning is essential to ensure that a suitable variety of habitats exists across the landscape.

Native forests are adapted to natural disturbances such as fire, flood, and ice storms. Although these events can be catastrophic, they nonetheless contribute to the diversity of habitats and provide other ecological benefits. Human activities, like timber harvesting, can be planned to mimic natural disturbances to a certain extent, and some natural disturbances can be tolerated or simulated to create desired results (Perry 1994a).

Certain species depend on structural characteristics that may not be available in an intensively managed forest, although more attention is now being paid to the importance of these habitat features in commercial forests. For example, snags, downed and decaying logs, and associated soil organisms are important for cavity nesters. Green trees can be left standing in harvested sites to become future snags, and when they inevit-ably fall, they become downed logs. Maintaining a supply of large, dead trees - particularly species like ponderosa pine, aspen, and oak - is important for soil replenishment and other biological factors (Bunnell et al. 1997).

Habitats such as wetlands, caves, talus slopes, and high cliffs provide valuable roosting and nesting areas for many wildlife species that benefit the ecosystem. For example, cave-roosting bats play an important role in maintaining energy flow in riparian and upland ecosystems, preying on forest pests, and providing a good source of food for other mammals and birds (Nelson et al. 1995).

Cutting patterns can be modified to improve the ecological condition of forests. For example, single-tree and small-group selection can be used to protect forest habitats and provide commercial benefits. Increasing rotation age yields larger trees with better nesting characteristics. Thinning smaller and weaker trees enhances the growth potential of larger trees (Perry 1996). Assuming that larger trees will be harvested at some time creates a balance between trees harvested and maintained (Messinger 1997).

Planning that avoids forest fragmentation helps to protect biodiversity. Timber harvest, road building, recreational development, and other activities fragment forest habitat. Harvests that maintain some connectivity between patches may benefit large carnivores, small mammals, amphibians, and other animals that may be vulnerable to disturbance or predation. Habitat linkages also can aid in dispersal of seeds and facilitate the re-establishment of vegetation after a disturbance (Logan and Fletcher 1996).

Improperly placed or maintained roads can affect surface and groundwater drainage patterns. To the extent that natural hydrological processes can be maintained, erosion and damage to fish habitat will be limited (Logan and Fletcher 1996).

Riparian areas provide disproportionate benefits to a broad range of species, including anadromous and resident fish, amphibians, invertebrates, and neotropical birds. Healthy riparian systems also help to filter contaminants, to limit sediment and pollutants entering the stream, to control flooding, and to improve water quality. Limiting timber harvest within riparian areas is essential to good forest stewardship, and active management of riparian areas may be necessary to restore ecological benefits. For example, in the Oregon coast range, salmonberry and alder thickets limit the establishment of conifers, which when they fall provide large woody debris in the streams, slowing water flow and creating fish habitat. However, managing riparian areas exclusively for conifers to benefit fish could limit the hardwood habitat needed by songbirds (Bunnell et al. 1997).

Fish habitat can be improved with structures that resemble large woody debris. Streamflow can be altered to create side-channels for fish spawning and rearing. However, these artificial measures are expensive and at best short-term fixes. A more cost-effective approach uses natural processes to restore hydrologic functions and fish habitat. According to a report of the American Fisheries Society, stream restorations would have a greater chance of succeeding if they were planned at the watershed scale and included reduction of up-slope and riparian conditions that cause stream habitats to decline (Roper et al. 1997).

A sustainable forest needs healthy soil to support vegetation. Erosion control techniques include the use of special equipment to minimize soil disturbance and prompt reforestation of disturbed areas. Proper road placement, building, and maintenance are essential. Although some landslides occur naturally and may be beneficial, using protective techniques to harvest unstable slopes is important to prevent mass wasting of hillsides (Sidle 1980, Adams 1989).

Logging roads can cause ecological damage by disturbing the soil, disrupting stream flow, contaminating waterways, and providing access to sensitive areas that can be vandalized or overused by people. Where possible, roads should be located away from water. Culverts may be re-designed, both for 50-year storm frequencies to reduce sediment loading in streams and for correcting culverts that block fish passage. Roads no longer needed for timber operations may be closed. Road drainage should not go directly into water bodies, but could be routed through a vegetation filter. Temporary roads and special equipment (such as single-grip harvesters) can be used to minimize the need for roads (Logan and Fletcher 1996).

Careful and judicious use of herbicides, pesticides, and fertilizers will protect water quality and avoid killing nontarget species. Compared to agricultural and residential lands, most commercial forests are light, infrequent users of chemicals and are closely regulated by the Environ- mental Protection Agency.

Certain alien plants - e.g., bamboo, kudzu, Himalayan blackberry, Scotch broom and English ivy - have invaded forest sites, inhibiting re-establishment and growth of native species. Techniques to control these plants include hand pulling, burning, mowing, and use of herbicides and biological agents. Managers should be aware of the potential of vehicle tires, equipment, tools, and boots to be vectors of exotic plant seeds. Careful washing of these items may help control unwanted seed dispersal. The most effective strategy is to act quickly to control exotic plants before they become established (Bureau of Land Management 1996c).

Aggressive fire suppression in some forests has contributed to forest health problems, including destructive insect infestations, dangerous fuel accumulations, and a change in the composition of tree species. Use of prescribed fire, properly timed and controlled, can help restore damaged forest ecosystems, although in some cases fuel loads will need to be reduced initially. Thinning also can be used to remove shade-tolerant conifers (Bunnell 1997). Conflicting regulations

limiting the use of fire need to be resolved. For example, federal Clean Air Act standards often restrict burning as a management option (Hanus 1997).

Existing and Promising Incentives

This section offers a discussion of promising incentives for encouraging conservation in commercial forests, small woodlot, and native forests.

Commercial Forests

Commercial forest lands include public and private lands managed primarily to produce revenue from harvested timber. They include private landholding in excess of 5,000 acres and state and federal forests managed for commercial timber production. Although the management of these lands may be similar, the incentives needed to stimulate improved stewardship may differ by ownership. However, all landowners need incentives that are easy to understand and to participate in, as well as incentives that are consistently available and effective for managing timber.

Stewardship certification has been undertaken by several nonprofit and industry organizations. Landowners who want third-party certification must meet management standards specified by the certifying organization. One motivation for certification is the potential for green marketing, based on the assumption that consumers prefer goods produced under sustainable management guidelines and will pay more for them. However, according to some certifiers, landowners are more interested in the benefits associated with receiving an independent, credible review of their operations with suggestions for improvement and increased market share driven by the public's knowledge of a company's good management (Gretzinger 1997).

Certification by the Forest Stewardship Council

The Forest Stewardship Council (FSC) is an international, non-governmental organization that establishes general principles and criteria for certification, accredits certifiers worldwide, and monitors activities to ensure credible assessments.

The organization has accredited five certifiers to apply criteria and procedures that satisfy FSC standards. The FSC has diverse representation from relevant economic, environmental, and social sectors.

In Oregon, The Rogue Institute for Ecology and Economy works with the Rainforest Alliance's SmartWood Program to conduct independent, performance-based evaluations of forestry operations on the ground.

The Rogue Institute uses FSC accredited guidelines that follow these general principles and criteria:
1. Forest management shall respect all applicable laws, treaties, and agreements of the country in which they occur and comply with all FSC all principles and criteria.
2. Long-term tenure and use rights to land and forest resources shall be clearly defined, documented, and legally established.
3. Legal and customary rights of indigenous people to use the land and resources shall be recognized and respected.
4. Forest-management activities shall maintain or enhance the long-term social and economic well-being of forest workers and local communities.
5. Forest-management operations shall encourage the efficient use of the forest's multiple products and services to ensure economic viability and a wide range of environmental and social benefits.
6. Forest management shall conserve biological diversity and its associated values, water resources, soils, and unique and fragile landscapes and ecosystems and, by so doing, maintain the ecological functions and integrity of the forest.
7. A management plan, appropriate to the scale and intensity of the operation, shall be written, implemented, and updated. The long-term objectives of management and means of achieving them shall be clearly stated.

8. Monitoring shall be conducted that is appropriate to the scale and intensity of forest management. It should assess the condition of the forest, yield and chain of custody for forest products, and management activities and their social and environmental impacts.
9. Primary forests, well-developed secondary forests, and sites of major environmental, social, or cultural significance shall be conserved and shall not be replaced by tree plantations or other uses. (Primary forests are the most natural. Secondary forests have regenerated naturally after human disturbance.)

Source: Steve Gretzinger 1997. Rogue Institute for Ecology and Economy, Ashland, Oregon

Certified Forest Stewards: A Family Affair

One of the first timber companies to become a certified forest steward was Collins Pine, a family-owned timber company headquartered in Portland, Oregon.

The certifying company - Scientific Certification Systems, Inc. - conducted an extensive, 8-month evaluation of Collins' 92,000-acre forest in northern California. The evaluation considered elements of timber sustainability, forest-ecosystem maintenance, and socio-economic benefits. The company scored more than 80 percent in each category.

At Collins Pine:

- No clearcuts are permitted.
- Large, old trees remain in logged areas.
- Large decaying wood and snags are left for wildlife.
- Roads are located away from streams.
- Stands have a variety of species and ages.
- Trees selected for harvest are either diseased or at the peak of their growth, meaning that only healthy, vigorous trees are left standing.

Certification has generated favorable attention for the company, now viewed as a model for sustainable forestry. Whether substantial, long-term benefits in the marketplace will be realized is unknown, but Collins Pine has clearly positioned itself as a leader in the industry with its willingness to integrate ecological, economic, and social values in managing the forest.

Source: Western Forester. 1996. "Collins Pine receives sustainable award." Vol 41, no. 7.

Although certification has promise, a number of factors have inhibited widespread adoption. Demand from consumers has been limited, although polls indicate that given a choice, a substantial percentage of the public is interested in purchasing environmentally friendly wood. Another potential barrier is the expense and complexity of the certification and monitoring process. Some certification standards require substantial changes in forest management that are perceived as too onerous by some landowners. Also, many lumber-mill owners and manufacturers have been reluctant to separate their stocks of sustainably grown timber from traditionally grown timber. Certification itself is hampered by the existence of several different schemes conceived according to different philosophies. Confusion in the marketplace is inevitable and may be the single greatest barrier to overall acceptance (Montgomery 1997).

Overcoming these barriers is likely to require additional education for producers and consumers of sustainable wood products, simpler and more and cost-effective approaches to the certification process, and additional incentives for producers of certified products. Marketing assistance can encourage the development of high-quality wood products that do not require large quantities of raw lumber. Building stronger links between forest management and forest products is important (Kohl and Franklin 1997).

Good community relations motivate large timber companies to adopt sustainable management techniques, based on the theory that companies with positive environmental images ultimately perform better in the marketplace. Taking voluntary actions to correct problems may forestall more restrictive regulations. Participation in watershed councils and other collaborative decision-making relative to natural resource management also enhances community acceptance of timber-management activities.

Tax reform can encourage landowners to adopt more sustainable practices. For example, deferring property taxes until trees are harvested and allowing landowners to deduct restoration costs when incurred might encourage extended rotations and could produce major conservation benefits. Weyerhaeuser has suggested rolling back long-term capital gains taxes to pre-1986 levels to allow companies to manage their lands better and to remain competitive. Some members of the forest industry have also suggested that federal estate taxes have been responsible for the premature liquidation of timber and the fragmentation of forested landscapes nationwide (Siegel 1996).

Regulatory relief through alternative compliance might enable timber companies and landowners to meet or exceed environmental standards more efficiently. If granted the flexibility to develop and implement long-range plans, landowners could be exempted from specific laws or regulations. Examples of such strategies include watershed plans and stewardship agreements. These strategies are particularly appealing to landowners interested in reducing the uncertainty associated with forest-management policies.

Developing more effective ecological monitoring techniques would encourage private landowners to adopt new management strategies. A reliable, consistent, and straightforward approach to selecting and periodically measuring ecological indicators can serve as a unifying force in bringing diverse parties to the table to develop goals and to track progress. To date, monitoring has been sporadic and piecemeal. Lack of consistent information about the status of forest resources inhibits effective management.

Land exchanges in which private lands with important ecological values can be exchanged for public lands more suited to commodity production can be used to meet regional conservation goals (Wright 1997). Conservation easements, which impose voluntary restrictions on the use of private land and for which the owner is paid by public agencies or private organizations, can protect public values on privately owned lands. The payment to the owner compensates for lost economic opportunities. Easements are often implemented through deed restrictions monitored by the sponsoring organization to ensure compliance. Other types of incentive contracts also could compensate landowners for losses associated with managing land for biodiversity values and could guarantee the right to harvest in exchange for reaching certain habitat goals (Lippke 1997).

Sustainable Forest Initiative

The Sustainable Forest Initiative was developed by the American Forest and Paper Association, the national trade group representing the forest-products industry.

A task force of diverse interests developed a set of forest-management principles and guidelines that represent in some cases a dramatic departure from normal approaches to managing natural resources.

Although many companies have adopted some of these guidelines, no company has followed all of them, according to a 1996 brochure published by the association.

According to the National Council of the Paper Industry for Air and Stream Improvement (NCASI), in 1996, 15 member companies' memberships were terminated for noncompliance (NCASI 1997).

A summary of the guidelines follows:

- Broaden the practice of sustainable forestry by supporting research and by requiring members to develop programs and plans to achieve sustainability.
- Ensure prompt reforestation within a specified time following harvest.
- Protect water quality by supporting research, following government standards, and

protecting perennial lakes and streams.
- Enhance wildlife habitat by supporting research and by developing programs, plans, and policies to promote diversity.
- Minimize the visual impact of harvesting by controlling clearcut size and meeting green-up requirements before harvesting adjacent sites.
- Protect special sites by identifying and managing them and by consulting experts.
- Contribute to biodiversity by supporting research and using adaptive management.
- Continue to improve wood utilization by employing appropriate technology.
- Continue prudent use of chemicals to ensure forest health by meeting or exceeding legal requirements.
- Foster sustainable forestry on all forest lands through education and training of landowners and loggers.
- Publicly report progress annually and invite independent review by experts.
- Provide opportunities for public outreach at the state and national level.

Source: American Forest and Paper Association 1996.

Small Woodlot

Incentive programs will need to be flexible enough to accommodate substantial differences in the size of ownership, age of landowner, and overall economic and other management goals. Also, many smaller landowners lack the technical expertise and financial resources to develop and implement best management strategies. "What small woodland owners need are a package of items that are easy to understand, easy to take advantage of, available consistently over time, and which will enable them to manage their timber for the goals they have in mind" (Waldorf 1996).

Estate tax reform is frequently cited as an important step in protecting private forest resources. Heirs to small woodlots are sometimes forced to harvest or subdivide them to pay estate taxes. Tax exemption or deferral for those who own sensitive habitats, hold stewardship certification, or comply with regional or watershed conservation plans, would be appealing to some landowners. Another approach would be to grant estate tax relief to any forest landowner agreeing to harvest according to a long-range plan.

Education and technical assistance are essential for owners of small woodlot who cannot afford to hire consultants to advise them on management strategies. Many woodlot owners are willing to apply good management practices if they know what they are. Maintenance and expansion of university extension programs, with a special emphasis on the production and distribution of user-friendly information on profitable, ecologically sound, and cost-effective management strategies, is essential. Such programs encourage good stewardship consistent with other uses. Moreover, special recognition for exemplary land stewards may inspire others to adopt sustainable management strategies.

Direct financial assistance, such as cost-share money and watershed-improvement grants, may be required in some cases where landowners have habitats of special importance; where particularly serious management problems exist, requiring significant investments in restoration; or where public benefits associated with limiting timber harvest are substantial. Direct financial assistance could be contingent on consistency with regional or watershed-level conservation plans.

Developing and marketing specialty products can provide income to small woodlot owners managing land for a diversity of native plants and animals. Examples include gourmet mushrooms, hardwoods for furniture and crafts, and floral products. According to the Rogue Institute for Ecology and Economy, nontimber forest products can be sustainably harvested more frequently than can trees and represent viable economic opportunities. For example, some researchers believe that salal, a common forest shrub harvested for floral use, can produce a better return than timber (Borsting 1997b). The harvest of special forest products has relatively light impact on soil and vegetation and requires little or no fertilizer or pesticides (McAllister 1996). However, at higher levels of intensity impacts may increase (Messinger 1997). Improved distribution networks and better technical assistance are needed. More research is needed to determine what level of harvest can be sustainable (Hanus 1997).

Managing forests for recreation and wildlife habitat can generate income from various sources - such as hunters, birders, and hikers - and may also be compatible with some extraction of forest resources. Use of public funds is sometimes authorized to facilitate access to private lands and can supplement income from other sources (McAllister 1996). This

approach will help users pay for public values on private lands (Messinger 1997).

Native Forests

Most forests managed explicitly for their natural values are in public ownership. These include federally designated wilderness areas, late successional reserves under the President's Northwest Forest Plan, some municipal watersheds, some state parks, and a handful of local parks. Private forests protected for natural values include some owned by The Nature Conservancy or held in private land trusts.

Some forests, particularly late-successional reserves on federal land, are managed to enhance old-growth characteristics on previously harvested sites. In many cases, thinning will be required to promote the growth of big trees (Bailey 1996). In any case, active management of native forests is often required to protect natural values. Some believe that managers of public lands should not be offered incentives to practice good stewardship. However, ecological problems exist on public lands, and the managers of these lands could benefit greatly from incentives and other forms of support. Recreational use, exotic plants and animals, catastrophic fires, logging roads, and altered hydrologic functions are just a few of the many factors that can combine to form significant ecological problems. Even past management practices, such as fire suppression and the deliberate removal of large woody debris from streams, continue to pose management challenges. Education is critical. Many land managers are not familiar with ecosystem management strategies and need easy access to updated information about the practical application of stewardship principles. Regional planning also is essential. Native forests exist in a larger context which, to a certain extent, helps determine management strategies.

Several incentive options have potential for managers of public and private native forests. Stewardship awards could be given to agencies, individuals, or interagency management teams whose conservation of natural forest land is exemplary and serves as a model to others. Promoting restoration efforts and providing cash awards to cover the cost of interpretive displays would provide additional incentive. Incorporating stewardship standards into performance evaluations, employee compensation packages, and promotions should help to focus attention on stewardship goals and serve as an inspiration to many public employees.

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SECTION THREE Part III

Major Land Uses continued

DEVELOPED LANDS

For this discussion, developed lands refers to residential or industrial lands. As municipalities around the nation wrestle with increasing population and development pressures, comprehensive land-use planning that considers biodiversity values as well as human needs becomes paramount.

Contribution of Developed Lands to Biodiversity

Although densely populated areas contribute less to biodiversity than do rural landscapes, the contribution is nevertheless significant. Some would argue that the primary contribution made by urban residents is living with density. By living in tight quarters, urban residents help save the open countryside. At the same time, industries and city dwellers contribute state tax dollars to support statewide environmental programs that help conserve water, wildlife, forests, and parks. Additionally, much of the tourism revenue in rural areas comes from urban residents, and many land-conservation programs depend on political and financial support from metropolitan areas. These programs include support for the activities of watershed councils working statewide to restore damaged habitats.

The developed landscape also supports biodiversity more directly by providing habitat for some wildlife, including endangered species. The peregrine falcon, a federally listed species, nests under bridges and on the ledges of high-rise buildings in some cities. The Congress Avenue Bridge in downtown Austin, Texas, is home to thousands of bats and constitutes the largest urban bat colony in North America. Backyards, managed with wildlife values in mind, provide valuable cover and wildlife habitat (O'Toole 1997).

The most important focus of biodiversity programs in urban areas should be to help people gain a better understanding about ecosystems, how they function, how they are affected by human activities, and why all of this is important. The most meaningful way for people to learn is to participate directly in efforts to conserve the natural world. Only through such experiences are people likely to internalize environmental values and change their behavior. Although choosing native plants for landscaping, cleaning up the beach, turning off lights when leaving a room, recycling, and riding the bus may not make a dramatic individual impact, the cumulative effect of many people making these choices and acting on them is an important step toward a more sustainable society. By engaging in these activities, urban residents may gain a better understanding of the challenges faced by farmers, foresters, and other rural residents as they attempt to change the way they do business.

Another important goal for biodiversity management in urban areas is to minimize or correct major disruption to ecological processes, especially in regard to impacts that can extend well beyond developed areas. The most obvious example is water management. Maintaining water quality and flow and protecting or restoring ecological function in riparian and floodplain areas are essential components of urban conservation programs.

Biodiversity Issues and Impacts

Urban development has had extensive and profound impacts on native biodiversity, in many cases virtually eliminating any trace of natural vegetation. Where areas have been paved and landscaped, where streams have been diverted and channelized, the changes are likely to be permanent.

Stewardship Principles and Management Recommendations

This section offers some examples of things urban residents can do for biodiversity. The list is by no means exhaustive. It is intended to give readers some opportunity to make a difference within the context of their daily lives. Although each landowner's management strategy will vary, several common themes should be addressed to meet regional conservation goals within a developed landscape.

Managing transportation from a regional perspective will often determine growth and development patterns that either protect or consume existing open spaces where biodiversity exists or could be restored. Minimizing road building, especially roads that fragment habitat; containing sprawl; and reducing fuel consumption are all important goals in designing transportation systems.

Managing growth through increased density within urban growth boundaries helps protect open space outside the boundaries. Comprehensive planning that includes the establishment of parks and natural areas is the best way to protect habitat in developed areas. Boston's "Emerald Necklace," though designed for urban recreation, forms a core of potentially important greenspaces for wildlife habitat. The Portland, Oregon, Metro Regional Parks and Greenspaces Program, approved by voters, outlines an ambitious strategy to purchase open spaces and connect them with trails and greenways (Metro 1995). Eugene, Oregon, is creating a connected system of wetland and upland habitats encompassing more than 14,000 acres. It should be completed within the next decade (West Eugene Wetlands Project 1997).

The arrangement of natural areas within the urban environment should consider the potential benefits associated with linking greenspaces. Avoiding development in sensitive habitats like wetlands and riparian areas and helping communities plan wildlife habitat by watershed will provide multiple benefits for recreation and quality of life. Conservation and recreation goals can be compatible and addressed together in urban planning.

Water quality and quantity are important to conserving biodiversity in any setting. Controlling harmful discharges through regulation of industrial point sources has been very successful. The focus in the future will be on more dispersed nonpoint sources. Watershed-level planning addresses a broad range of land uses and management practices throughout each river basin. Even in urban settings, significant elements of biodiversity can be restored by reconnecting rivers to their floodplains and by using wetlands to help filter and purify water before it enters streams.

A transition to more natural landscaping could produce benefits for biodiversity. Some habitat is provided when urban gardeners grow native plants or nonnative species that can be used by urban wildlife - principally birds, butterflies, and a few small mammals. More natural landscaping also requires less water and fewer chemicals. Removing invasive exotic plants such as English ivy, Scotch broom, and Himalayan blackberry is an important element of biodiversity management.

Environmental education is essential for urban residents whose connection with the natural world has been disrupted and is most effective when people are given an opportunity to learn by participating directly in conservation efforts.

Management Practices and Incentives for Specific Developed Lands

This section discusses some management practices and incentives for urban land uses that collectively comprise a large area: commercial and industrial lands, residential lands, and parks, schools, and cemeteries.

Commercial and Industrial Lands

A number of actions can be taken by industrial and commercial landowners to help meet conservation goals. Participation in watershed planning to identify the highest-priority conservation actions within a regional context as well as a willingness to assist local organizations may enhance community support and help prioritize conservation actions.

Establishing a mitigation bank for habitat funds allows more effective targeting of investments. For example, money spent on delineation and mitigation for the destruction of minor wetlands in heavily developed areas might have a greater impact if spent on larger or ecologically functioning sites where potential ecological values are greater.

Property-tax relief could be provided to commercial and industrial landowners who comply with regional conservation plans and make a special effort to implement them on and off site. Market-based incentives exist for entrepreneurs to provide native plants, landscape design, installation, and consulting services. In Minnesota, Prairie Restorations, Inc.,

provides high-quality seeds, plants, and assistance to homeowners using naturalized landscaping (Platts 1997).

Residential Lands

Urban and suburban residents might be encouraged to take steps to conserve biodiversity if incentives were available. For example, urban residents willing to donate property, or to sell at less than market value, to a trust for preservation can avoid paying high property taxes. Local land trusts can provide maximum benefits for biodiversity if reserved lands are strategically placed within a larger ecological context and managed to protect native species.

Tax incentives may help motivate homeowners to implement stewardship guidelines. For example, counties or municipal governments could reduce property taxes by 1 percent for homeowners who follow conservation guidelines for the use of such elements as water, chemicals, and native plants and by 2 percent for homeowners who follow those guidelines and whose individual activities are also consistent with a larger urban plan. A similar incentive is the policy of reducing sewer rates for homeowners who disconnect downspouts. Private certification programs like the National Wildlife Federation's backyard habitat project can help people learn about wildlife and habitat needs through direct participation (Tufts 1988).

Parks, Schools, and Cemeteries

Parks, schools, and cemeteries have many opportunities to participate in conservation programs. Providing education is itself an important first step (see box). Local parks, schools, and watershed councils can all assist people in learning about urban ecosystems and how individual activities affect them. Community businesses can help finance educational efforts.

Parks and schools play an important role in taking their education programs one step farther by providing their constituents with meaningful, hands-on activities that develop a greater awareness of the contributions they can make in their developed environment and beyond. Students and other volunteers can participate in restoration and clean-up efforts that encourage awareness and sensitivity toward natural ecosystems.

Using biodiversity-friendly management practices at cemeteries can provide important help for biodiversity conservation. In some grassland areas, cemeteries represent that last remaining plots of native grass species. Cemeteries also can provide relatively large stands of natural habitat in the urban environment, making them prime birding areas for species such as owls. Managers can augment these factors by, for example, using native plants in landscaping, converting lawn areas to grasses with lower watering requirements, and reducing the use of chemicals in grounds maintenance. Planting butterfly gardens might be an appropriate and compatible use.

Naturescaping

People interested in attracting wildlife to backyards, farms, and even commercial and industrial properties can refer to numerous publications on the growing trend in naturescaping. Some guidelines follow:

- Provide some food. Native plants will attract a variety of animals and require less water and care than introduced plants.
- Provide water. Water attracts more wildlife than specialized food. Building a pond, conserving a wet area, or placing a birdbath in the yard is a good starting point.
- Provide shelter. Allow leaf litter to accumulate under shrubs. Towhees and fox sparrows like to feed in the litter. When it decomposes it enriches the soil. Allow some weeds to grow. Many weeds supply seeds for birds and other wildlife. Build bat houses for the garden. On average, a single bat eats 3,000 to 7,000 insects per night.
- Provide protection. Wildlife needs cover from predators. Shrubs, food plants, rock and brush piles, snags, downed logs, and other woody material make good cover. Space is important. Animals need safety zones with food, cover, and water, especially during nesting season.
- Minimize or eliminate use of pesticides, herbicides, and chemical fertilizers. Birds, fish, and mammals are all sensitive, directly and indirectly, to chemical exposure through their food supply. Keep plants healthy, because insects prefer weak plants. Use insect-resistant plants and, when necessary, biological controls.

Source: Hirose *et al.* 1992

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SECTION THREE Part IV

Major Land Uses continued

CONSERVATION AND RECREATION LANDS

Conservation and recreation lands vary widely in their geographic distribution, size, level of development, management objectives, ownership, and other attributes. Although each is managed according to unique circumstances, all have issues in common. These are summarized below.

Contribution of Conservation and Recreation Lands to Biodiversity

Conservation and recreation lands provide the nation with some of its best opportunities to protect biodiversity. Many of these lands represent a treasured part of the nation s heritage contributing to our quality of life. These lands can be in either public or private ownership and may or may not be managed primarily for biodiversity values.

Government is the largest owner of conservation and recreation lands, including national parks, monuments, wildlife refuges, wilderness areas, scenic waterways, state parks and wildlife areas, and many local and regional facilities. These public lands support many elements of biodiversity.

The private sector also owns and manages significant conservation and recreation lands. The Nature Conservancy, for example, owns 1,500 preserves nationwide, totaling more than 9 million acres. These lands are managed primarily for their natural values, with biodiversity conservation as a major goal, Another important piece of the biodiversity puzzle includes golf courses, resorts, and other privately owned outdoor recreation facilities that, although not managed explicitly for biodiversity purposes, may become more important in the future, particularly near population centers where open space is in great demand.

Biodiversity Issues and Impacts

The existing network of conservation lands represents a patchwork created to meet specific demands that have shifted over time. Most land acquisitions and designations were driven by a desire to conserve spectacular scenery or geological features. Most federal wildlife refuges were intended to conserve migratory-bird habitat. Federal wilderness areas tend to be at high elevations, where valuable timber is scarce. And certain habitat types, such as low-elevation riparian areas, oak woodlands, and native grasslands, are generally in private ownership and primarily managed for purposes other than conservation and recreation. Nevertheless, the existing network serves as an important starting point for building a system in which all ecosystem types are represented and functioning.

Stewardship Principles and Management Recommendations

Although management practices and recommendations vary considerably among conservation and recreation lands, some general principles can be applied to help improve stewardship of these lands and to enhance biodiversity on them. One goal should be the creation of larger units of protected land. Many conservation and recreation areas are too small to be managed as functioning ecosystems and to support sustainable populations of native species. These are challenging issues and will require new approaches. Working with adjacent landowners, considering land trades and easements, and participating in regional planning are all necessary to address the problem (National Research Council 1993).

A concerted effort also needs to be made to include all major habitat types in the conservation-lands network. Studies have

identified a number of major habitat types that are poorly represented in the existing conservation network. This information can be used to help managers decide how to prioritize conservation actions, including acquisitions, partnership agreements, and ecological restorations. Factors such as the optimum size of each area and potential connectivity with other sites are important considerations (Oregon Biodiversity Project 1998).

Maintenance of natural disturbance regimes has not been a primary management goal on most conservation and recreation lands but is now recognized as an essential part of ecosystem management. Accommodating fire, floods, and other natural disturbances on small sites is difficult but, where they can be managed, natural disturbances are important to ecological integrity (Noss and Cooperrider 1994). Similarly, programs to enhance biodiversity can benefit from evaluating dammed, diverted, or otherwise modified streams, rivers, and creeks to determine where it might be appropriate to restore natural hydrology (Gregory 1997).

Managers should avoid overdeveloping recreational areas and should protect natural areas to help to satisfy a growing interest, especially among urban populations, in nature education and less structured outdoor experiences. Lower capital and maintenance costs are consistent with decreasing resource-agency budgets. Fewer paved surfaces may improve habitat value and enhance ecosystem integrity (Hudson 1992). Natural lands also benefit when managers control visitors to minimize adverse impacts. Simply explaining to people why they should avoid certain harmful activities or make a special effort to engage in positive activities may have some impact on behavior. Restricting access to sensitive areas during certain times, like nesting season, may be sufficient (Larson 1995, Hudson 1992).

Water can be conserved by relying on native landscaping and watering only areas where native landscaping is not appropriate, such as playing fields and picnic areas. Water also can be recycled, and irrigation systems can be designed to reduce loss. Some grasses, like fescue, take less water than other types.

Minimizing use of chemical herbicides, pesticides, and fertilizers saves money, protects water quality, and avoids harm to nontarget organisms. Implementation of integrated pest-management strategies is important to biodiversity. Evaluating secondary land uses such as grazing, agriculture, and logging help to determine whether they are causing adverse impacts and, if so, how they can be modified or eliminated.

Avoiding the use of exotic plants in landscaping and taking steps to control invasive exotics can help to restore native ecosystems disturbed by the advent of alien species. Using volunteer labor to help remove unwanted plants, such as English ivy in urban parks, can help address the problem while improving the public's understanding of the issue. Allocating more resources to this important task will probably be necessary to the long-term ecological health of parks, natural areas, and adjoining properties.

Providing a good example and offering good public information are two of the most important contributions that conservation and recreation land managers can make to overall efforts to protect sustainable ecosystems. Demonstration projects, cooperative agreements with adjacent landowners, high-quality interpretive signs, well-informed staff naturalists and volunteers, and partnerships with schools, scientists, conservation groups, and local businesses can all help to meet biodiversity goals.

Participating in regional planning to help ensure that park and natural-area management fit within the overall watershed or ecoregional strategy helps to avoid inconsistent actions and duplication of effort and, in the long run, saves money.

Existing and Promising Incentives

Providing better information about biodiversity and ecosystem management to agency personnel, private organizations, and commercial managers may be productive and cost effective (Sjulin 1996). Providing broad-based funding for resource-management programs also is a boon for conservation. Revenue for resource agencies often comes from user fees such as hunting and fishing licenses and camping or day-use charges or from commercial activities on conservation and recreation lands. Often, the revenue source has driven conservation programs, as when programs funded by hunting fees focus narrowly on game species to the exclusion of nongame and endangered species. This approach can leave important resource monitoring, protection, and restoration programs without adequate financial support. A broader funding base and, in some cases, more total funding would improve stewardship (Sjulin 1996).

Management plans should be developed in a way that helps to focus stewardship activities by framing the issues, involving the public and resource organizations, and establishing long-term goals and objectives. Site plans are more likely to support regional biodiversity goals if they are developed within the larger context and are compatible with adjacent land

management (Sjulin 1996).

Incorporating stewardship standards into performance evaluations and employee compensation packages helps to focus attention on goals and serve as an inspiration to employees, both public and private. Similarly, stewardship certification programs may appeal to both public and private managers. For example, golf courses have been certified by Audubon International under the Cooperative Sanctuary Program. Golf course managers pay to participate in this voluntary program because they believe it is important to their customers and improves community relations (see sidebar).

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SECTION THREE Part V

Major Land Uses continued

TRANSPORTATION AND UTILITY CORRIDORS

Pavement covers more than 60,000 square miles of the United States - about 10 percent of all arable land. Nearly half of all urban space has been developed to accommodate automobiles (Taxpayers for Common Sense and Friends of the Earth 1996)

Biodiversity Issues and Impacts

The impact of roads on biodiversity is significant. Roads fragment habitat, degrade and pollute streams, cause erosion, facilitate the spread of exotic species, and open access to even the most remote sites (Ryan 1995). Of particular concern is the proliferation of invasive exotic plants via roads of all kinds. The tires of vehicles driven in weed-infested areas pick up seeds and transport them great distances.

Highways can adversely impact large carnivores such as black bears, cougars, and wolverines. The large habitat requirements of these animals compel them to cross roads where they are subject to injury and mortality. Road upgrading, such as paving, new lanes, and fencing, substantially increases wildlife endangerment (Ruediger n.d.).

Ironically, roads also help to conserve biodiversity in some areas. Roadsides support some of the last remnants of native plant communities in areas dominated by agriculture, providing a place for increasingly rare plant species (Macdonald 1997).

Utility corridors have negative impacts similar to those of roads, particularly with respect to habitat fragmentation. When located in forested areas, utility corridors disrupt the continuous vegetative community, changing the structure and function of wildlife habitat. Utility corridors can cause behavioral changes in species, provide improved access for some species at the expense of others, and facilitate the spread of invasive exotic species (Gates 1991).

Stewardship Principles and Management Recommendations

In attempting to minimize adverse impacts of utility and transportation corridors, some common themes emerge. Using existing corridors or placing new roads along unused corridors helps to prevent additional habitat fragmentation (Ruediger n.d.). Minimizing edge effects in some cases can reduce predation and the disruption of habitat used by sensitive species (Gates 1991).

Decommissioning and closing roads is a necessary and important part of a biodiversity strategy (Ruediger n.d.). Many watershed councils, resource agencies, and private companies have identified nonessential roads in ecologically significant areas and have recommended closing them to restore the landscape. These activities should be encouraged and expanded under any incentive programs that are implemented.

Reducing chemical use can help to avoid contamination of waterways and harm to sensitive wildlife species (ODOT 1996). Using native species to revegetate disturbed areas improves habitat quality and could reduce maintenance costs. Alternatively, landscaping with native compatibles can achieve similar objectives. For example, wildflowers have considerable aesthetic appeal, need little maintenance, and attract butterflies, insects, and birds. Avoiding wildflower mixes containing noxious weeds will help to control their expansion. Controlling the spread of invasive exotic plants and animals

should be an emphasis in corridor design, placement, and maintenance (Bureau of Land Management 1996c).

Minimizing direct wildlife mortality is important in areas where roads or utility corridors cause particular problems. Vehicle collisions with deer and other mammals are a serious problem along many roads and highways. Underpasses, special fencing at traditional wildlife crossings, and warning devices placed directly on automobiles can reduce collisions.

Wetland mitigation is often required when roads are constructed or modified. Presently, mitigation is focused primarily on restoring sites at or near destroyed wetlands. Considering mitigation more broadly by including off-site mitigation as a potential measure would provide more flexibility by directing investments to the most ecologically significant projects rather than only to projects on or near the site of impact (Taylor 1997).

Existing and Promising Incentives

Highway Maintenance Departments and Contractors

Stewardship certification could be offered to departments for individual roads or road segments or to special projects for road construction, design maintenance, and modification. Certification could be awarded by third parties composed of diverse interests from the public and private sectors. Stewardship awards also could be offered to individuals, departments, or interdisciplinary teams for effectively incorporating biodiversity management goals into transportation projects.

Stewardship standards could be incorporated into performance evaluations and employee compensation packages to focus attention on goals and to motivate public employees. Writing stewardship guidelines into construction contracts, or giving special consideration to contractors with experience in accommodating environmental issues, may also be feasible. Special training workshops could help people understand the importance of managing ecosystems more carefully to avoid adverse impacts of corridors.

Utilities, Railroads, and Timber Companies

Positive public relations are often sufficient to motivate large utility companies and other corporations to adopt improved management strategies, if the cost is not too high. The opportunity to avoid regulation also may encourage companies to implement management guidelines voluntarily. Closing unneeded logging roads may help fish recovery. Landowners could receive direct financial assistance and other incentives to close and decommission roads. Timberland owners could also benefit from reduced road-maintenance costs.

Other stewardship incentives - discussed in the forestry, agriculture, and recreation sections of this report - address road and utility-corridor management in the context of other land uses.

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SECTION THREE Part VI

Major Land Uses continued

MINERAL LANDS

Coal is the primary substance extracted from eastern mines, while western mining is dominated by hardrock minerals. The 1872 Mining Law governs hardrock mining on federal lands. It was one of many laws designed to lure settlers westward. It gave, and continues to give, hardrock miners access to all public lands not expressly withdrawn from mining. If miners can prove they have a valuable ore discovery, they can purchase (or patent) the surface land for as little as $2.50 an acre.

Biodiversity Issues and Impacts

Hardrock mines have contaminated 12,000 miles of U.S. streams, racking up billions of dollars in potential reclamation costs (Abel et al. January 19, 1998). Hardrock mining physically alters and fragments habitats when large amounts of vegetation are removed to erect structures or create access roads (Schonewald-Cox et al. 1992). Vegetation and topsoil loss can lead to slope instability and possible landslides, further degrading the native landscape (Mineral Policy Center 1995). In cyanide heap-leaching operations, birds and other wildlife can be exposed to chemicals in storage ponds. Thousands of waterfowl deaths have been reported from cyanide poisoning related to mining activities (Mineral Policy Center 1989).

The permissive Mining Law of 1872 essentially has freed miners and mining companies from government oversight. The law allows miners to search for minerals without a permit, to recover minerals without paying a royalty to the federal government, and, until 1981, to walk away from failed operations without having to reclaim the surface area. The law, in fact, has no provisions whatsoever for reclamation. However, since 1971, miners have been subject to the National Environmental Policy Act, which governs activities on federal lands. The upshot is that a mining company is generally required to reclaim the mine site. Other federal laws, such as Superfund and the Clean Water Act, are occasionally stretched to cover problems stemming from old mines. But without a specific federal law aimed at hardrock-mining reclamation, cleanup is difficult to enforce. In the absence of direct federal regulation of hardrock mining, states tend to be in charge, and the efforts and successes are as varied as the states.

Despite the fractured nature of hardrock-mining regulation, most participants agree that, when implemented, the regulatory system is a punitive process with little flexibility. Regulators, the mining industry, and most environmental groups concur that regulation needs to be relaxed to allow for incremental cleanups. Some cleanup is better than none, they reason.

Recent attempts to reform the 1872 Mining Law have tried to establish a reclamation process that is fair and encourages responsible stewardship. To date, reclamation efforts have succeeded mainly in eastern coal mines, where federal law now requires coal-mine owners to pay fees that can be used to reclaim old coal mines. Proposed reforms for hardrock mining would parallel the coal reclamation law, imposing royalties and fees on hardrock mining and directing a large portion of the proceeds toward reclaiming old hardrock mines.

Mining operations can pose serious threats to the health of aquatic systems, which are threatened by four primary factors:
1. Acid drainage occurs when surface and underground mining cause sulfide-rich ores to leach into stormwater runoff, threatening wildlife and leaving water undrinkable (Mineral Policy Center 1995).
2. Heavy metals contamination (lead, cadmium, arsenic, mercury, and aluminum) of waterways via stormwater can cause fish kills and water sterilization (Kelly 1988).
3. Erosion and sedimentation from unreclaimed mining sites can alter stream structure and increase turbidity, destroying fish and wildlife habitat and reducing primary production and food availability (Mineral Policy Center 1995).

4. Chemical pollution is most commonly associated with the gold-mining practice of cyanide heap leaching, in which ore is treated with a cyanide solution to free the gold. Storage ponds designed to withhold the cyanide from the environment can be overwhelmed during times of heavy rainfall, allowing the toxic solution to enter waterways and destroy aquatic organisms (Mineral Policy Center 1995).

Even small-scale placer mining can cause adverse impacts on aquatic ecosystems. These operations disrupt fish migration and spawning grounds, destroy eggs and young fish, cause stream siltation, damage riparian vegetation, and change stream channels. The cumulative effects of many small operations in the context of other disruptive activities on the landscape are poorly understood (Oregon Division of State Lands 1996).

Aggregate mining operations, which extract sand and gravel from streams and rivers, can alter channel contours, create stagnant side-channels, deplete spawning gravel, degrade spawning beds (Koldolf 1994), increase suspended sediments, and affect water temperature (Wissmar et al. 1994).

Ecologically beneficial aggregate mining can be used in conjunction with floodplain restoration efforts. For example, revenue from sand and gravel extraction can help finance stream-bank shaping and the creation of side channels to improve fish habitat. Possible use of adjacent gravel-mining floodplain ponds for flood refuges needs to be explored (Gregory 1997). Many opportunities exist for mutually beneficial partnerships between aggregate companies, agencies, and private organizations to reconnect rivers with their floodplains and to protect and enhance riparian and wetland habitats (Meinen 1997). However, scattered, opportunistic projects are not likely to accomplish long-term ecological goals. An overall plan is needed to make sure that projects in one location do not cause harm elsewhere.

Stewardship Principles and Management Recommendations

The Mineral Policy Center in Washington, D.C., offers the following guidelines for responsible mining (Mineral Policy Center n.d.):

- Overflow management is needed to prevent discharge of storage ponds containing harmful chemicals during heavy rainfall.
- Streams and runoff can be diverted from mining sites to prevent excess amounts of silt from entering waterways.
- Leak prevention and monitoring of storage ponds can be managed by positioning ponds on a layer of impermeable clay and using double synthetic liners with leak detection systems in between. A corrective plan is needed in the event of leakage.
- Blocking wildlife access to storage ponds is necessary to protect birds and other wildlife.
- Proper discharge of contaminants is necessary to prevent water contamination.
- Reclamation and landscaping are needed to prevent acid mine drainage and leaching of heavy metals from waste piles. Control contaminant runoff from waste piles, or cap waste piles with impermeable clay.
- Frequent surface and groundwater testing and a corrective plan are important steps in addressing potential contamination.
- Local citizen oversight boards can facilitate community involvement and good public relations.

To the extent that new mining operations are approved, additional actions are recommended to meet biodiversity goals:

- Pre-mining vegetation assessments can help guide restoration of natural habitat after an operation is finished (California Council on Biodiversity 1995a).
- Reshaping the landscape to its original condition and removing human-made objects at the site can enhance mine appearance and biodiversity value (California Council on Biodiversity 1995a).
- Using a biological assessment prior to modifying or closing existing mines will determine appropriate actions relative to protecting bats that are using abandoned mines. More than half the 43 species of bats living in the continental United States roost in abandoned mines, including some threatened and endangered species. Closure or alteration of old mines without biological assessment could eliminate some of America s largest bat populations. Installation of special gates could protect bats and prevent people from entering mines used by bats. Other management guidelines are found in Bats and Mines, a publication of Bat Conservation International and federal agency partners (Tuttle and Taylor 1994).
- Mining operations should avoid the following in aquatic habitats:
- Removing large amounts of material from streams.

- Constructing permanent dams or blocking entire streams.
- Disturbing plants growing on sand or gravel bars and stream banks.
- Removing woody material and boulders from streams.
- Disturbing streams where fish are spawning.
- Leaving rock piles or depressions in channels where fish can become trapped during low water (Oregon Division of State Land 1996).

Existing and Promising Incentives

Stewardship certification may appeal to mining and aggregate companies seeking good public relations. This option could be made more economically attractive if government agencies considered certified operators preferentially in awarding bids for road-construction materials. The opportunity for enhanced public relations may motivate mining operations to restore or create biodiversity-related habitat after mining operations cease (Morse 1997).

Financial incentives or in-kind assistance also could be used to encourage companies to do more ecologically beneficial restoration than the law currently requires. For example, government could offer financial incentives to companies to shape shallow pools and re-establish native emergent vegetation when mining operations cease. Financial incentives may encourage land donations to resource agencies or nonprofit organizations. Aggregate pits cause potential liabilities for the landowner, especially if they are near urban areas. Donating land also relieves landowners of property-tax obligations (Meinen 1997).

Creative exchanges of land and services can be negotiated between mining companies and agencies. For example, companies can assist in restoring damaged areas on public lands by donating use of equipment, labor, and materials in return for access to resources on public lands where resources would not be damaged (Meinen 1997).

Awards can be offered to operators exceeding state requirements.

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SECTION FOUR Part I

Major Cross-Landscape Influences

Two land-management issues - aquatic/riparian systems and exotic species - are addressed separately in this section because they cut across all land uses and are immensely significant to biodiversity. Aquatic and riparian systems generally have a disproportionately high value to wildlife, supporting a greater variety and abundance of plant and animal species than do surrounding lands, especially arid lands. Invasive exotic animals and plants are highlighted here because of the serious threats they pose to native ecosystems.

AQUATIC AND RIPARIAN SYSTEMS

The places where land and water meet have special ecological and cultural significance. Plants, animals, soils, and people all depend on water and have an effect on the overall health of aquatic systems. Rivers, streams, wetlands, riparian lands, floodplains, estuaries, and other aquatic resources occur across the entire continent, intertwined with various land uses. Ecologists know that no clear separation exists between land and water; that rivers are connected to the watersheds that sustain them. Bureaucratic attempts to address land and water as if they were separate entities have led to many confusing policies that are inconsistent with ecosystem-management goals. Addressing water issues by looking at one land use at a time is insufficient because water flows across all ecosystems regardless of their management. Water and its relationship to the land needs to be considered more holistically. Managers should avoid the administrative dichotomy that has created so many problems.

Contribution of Aquatic and Riparian Systems to Biodiversity

Wetlands, estuaries, and riparian areas play an important role in controlling floods by reducing the speed and velocity of the flow and trapping sediments. They also act as natural water cleaners, filtering out excess nutrients, bacteria, and chemical contaminants. Many species of wildlife depend on wetland and riparian systems for food, shelter, and water.

Stewardship Principles And Management Recommendations

Several stewardship principles and management recommendations specific to aquatic and riparian systems are discussed below. Many recommendations in previous chapters are also applicable.

The National Riparian Service Team, jointly managed by the Bureau of Land Management and Forest Service, has developed a qualitative, science-based process for assessing the condition of streams and implementing measures to restore them to their highest potential. It focuses on stream function rather than on outputs such as forage and habitat on the assumption that maintaining ecological function is a necessary starting point before producing desired vegetative conditions.

The process involves researching the historical condition of streams, then establishing photo-documentation and other simple monitoring procedures to track improvement over time. Selected management techniques, consistent with the potential of the site, are applied. For example, vegetation is replanted on stream banks to reduce erosion, beavers are encouraged to build dams, large woody debris is placed in forest streams, and erosion is controlled by limiting improper grazing and other erosive agricultural practices. Training workshops provide a common language that allows diverse participants to evaluate streams on the ground consistently. The riparian team also assists participants in untangling red tape that inhibits implementation of improved land-management strategies (Bureau of Land Management 1996b, Bureau of Land Management and USDA Forest Service 1997).

Many stream restoration projects fail because they have been implemented at a small scale and on a site-specific basis. Assessment, restoration, and evaluation of watersheds should include people with expertise in fisheries and other disciplines such as ecology, forestry, range management, and hydrology (Roper 1997). One key restoration goal is reconnection of rivers and their floodplains by limiting development in high-risk areas. In some developed floodplain areas, it may be more cost effective to remove structures than to repair them repeatedly after floods (Gregory 1997).

Water quantity should be maintained at a level that supports native fish and wildlife. Although most states recognize the importance of maintaining in-stream flows, the reality is that water is over-appropriated from many streams. Diversions of the Colorado River, for example, have overtaxed the river, destroying most of its native riparian habitat and endangering species ranging from fish to birds. In addition to water quantity, water quality also needs to be protected by controlling erosion and reducing runoff that contains harmful chemicals, fertilizers, and contaminants.

Classifying riparian and wetland vegetation into specific zones can help to focus and prioritize restoration efforts based on ecological potential, land use, condition, level of development, degree of flood risk, cost, and other factors. Restoration of vegetation can help to maintain the cool water temperatures to which most river species are adapted. Temperature also can be improved by management that improves a stream's depth-to-width ratio (Svejcar 1997).

Stream banks need protection from severe erosion, and in some cases this need may call for employment of rip-rap or other measures. However, restoring the natural functioning of streams, including native vegetation, is usually more cost effective than employing such artificial stream-bank protections. Historically, approximately 80 percent of in-stream artificial structures have failed (Elmore 1997).

Fish habitat can be protected and restored by creating side channels, adding spawning gravel, and placing large woody debris in streams to restore fish spawning, rearing, and feeding areas.

Providing structures that help fish get around such impediments as dams can facilitate fish recovery in many rivers and streams. Screening that keeps fish from being sucked into irrigation canals is also critical to survival for some fish stocks. Leaving beaver dams in place, if possible, generally enhances the health of aquatic ecosystems.

Water impoundments can be either beneficial or harmful, depending on landowner goals. In some cases, artificial lakes and ponds provide good wildlife habitat, especially if they are properly shaped to provide a variety of water depths and to allow birds, amphibians, and other animals easy access and egress. Improperly designed impoundments can block fish passage, can attract unsuspecting mammals that are unable to escape from deep ponds, or can become stagnant and infested with algae. In some cases, removing drain tiles and dikes to restore natural water flow and associated floodplain/wetland habitat is the best measure for enhanced biodiversity.

Exotic organisms should limited or eradicated from aquatic systems. In some cases, removal of exotic fish or other species may be necessary if the exotics are bringing adverse impacts to native species. The introduction of exotic organisms should be avoided.

Watershed and basin plans should address aquatic and riparian issues in broad context. Consideration of wetland permits within the context of these plans could provide a more coherent approach to wetland conservation. Planning that incorporates larger landscapes is necessary to ensure long-term integrity of aquatic and riparian systems (Leibowitz 1995). Priority areas should be designated on the basis of functional value and representative type before long-term protection is initiated.

Existing and Promising Incentives

To a certain extent, potential incentives for conserving rivers, streams, and wetland and riparian areas are covered in other sections of this report. If incentive programs are administered on a watershed or ecoregional basis, then attention to overall ecosystem health and functioning will address water issues. In fact, attention to water quality, quantity, and fish habitat often drives conservation planning to the exclusion of other values. However, some incentive options may be especially applicable to aquatic ecosystems. For example, integrating local, state, and federal wetland regulations helps to reduce some of the frustration and animosity landowners feel when they get caught in the bureaucracy of the wetland permitting process. One-stop shopping for wetland permits would be helpful (Leibowitz 1995). A streamlined permit process for wetland enhancements would help to remove obstacles to restoration. For example, if an approved stewardship plan is in place, and wetland or riparian restoration is part of the plan, landowners could be exempt from other permit requirements. This opportunity exists to some extent but should be continued and expanded.

Stewardship of aquatic and riparian systems on public lands should be improved to help meet overall conservation goals and to provide examples to private landowners (Leibowitz 1995). Specific state policies are needed to protect existing floodplain areas and to encourage restoration of historic floodplains. Providing maps of these lands to planners and the public would be helpful (Gregory 1997).

Improving information about the location and relative importance of wetland habitat would help landowners manage aquatic and riparian systems properly (Leibowitz 1995). This includes highlighting important linkages between lands (Gregory 1997). Expanding direct investments in aquatic and riparian system restoration, including technical assistance to landowners; cost sharing; in-kind contributions of equipment, plants, and materials; purchase of easements; and acquisition of high-priority sites from willing sellers, would help to stimulate commitment to riparian restoration. Providing dedicated funding for aquatic and riparian conservation also would help to garner such commitment. Many conservation programs are not as effective as they could be because they lack dedicated funding.

Other incentives include:

- Providing technical, financial, and marketing assistance to landowners interested in maintaining riparian areas and harvesting riparian products (black walnuts, floral and nursery products, mushrooms, and plants with medicinal and pharmaceutical properties) (McAllister 1996).
- Assisting landowners in providing low-impact, fee-access recreational opportunities in aquatic and riparian areas, such as access for fishing and bird watching (McAllister 1996).
- Modifying criteria for bank loans and qualifications for public agricultural subsidies to reward farmers who protect riparian floodplain habitat (Gregory 1997).
- Establishing a high-risk zone within selected floodplains and using federal flood insurance as a stimulus to relocating structures and restoring ecosystems, for example, by providing 50 percent reimbursement to people for rebuilding flood-damaged structures within a floodplain, full reimbursement to people locating the structures elsewhere, and no reimbursement to owners of floodplain structures that have already been reimbursed and reconstructed after previous floods (Gregory 1997).

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SECTION FOUR Part II

Major Cross-Landscape Influences continued

EXOTIC ORGANISMS

Exotic, or nonnative, plant and animal species are part of every landscape across the nation. Most result from human activity, such as deliberate introductions, unintentional introductions, or habitat modification. Many introduced species are beneficial to human society. Almost all agricultural crops and domesticated animals, many sport fish and aquacultural species, and numerous horticultural plants have origins outside the nation, yet contribute to our daily lives.

A large number of exotics, however, cause significant economic, environmental, and health damage. They range from nuisances such as crabgrass and dandelions, to species like the medfly and European gypsy moth, which cost agriculture and forestry millions of dollars annually; to species posing human health risks, like the fire ant and African honeybee; to species that threaten widespread disruption of major marine ecosystems, like the zebra mussel.

Biodiversity Issues and Impacts

The spread of exotics is among the greatest threats to native biodiversity. Problems with exotic organisms exist to various degrees throughout the United States and across all land uses. The introduction of alien plants and animals has been going on for thousands of years. However, unintentional and deliberate introductions have accelerated during the past hundred years as human populations have become more mobile. Seeds caught in automobile tires, for example, can be transported vast distances before they drop off and germinate. Many nineteenth-century introductions were made by people unaware of the consequences (see, for example, carp and house sparrow introductions, below).

A few alien plants and animals have spread rapidly in the absence of natural controls. These invasive exotics can cause significant damage to desired crops, livestock, and natural ecosystems by competing with native plants and animals. Some scientists believe that nonindigenous species are second only to habitat destruction in harming native communities (Simberloff 1995). Nationally, 4,600 acres of wildlife habitat are estimated to be lost every day to exotic weeds (Williams 1997). People need to recognize these invasive pests, to appreciate the damage they can cause, and to participate in efforts to keep them from destroying gardens, agricultural crops, and native ecosystems.

The impacts of some invasive plants and animals are briefly examined below.

Invasive Plants

Unless otherwise noted, the following material on specific exotic plants and animals is adapted from Kozloff (1976) and Palmer (1975).

Purple loosestrife and reed canary grass can quickly dominate wetlands, reducing habitat values and species diversity. Purple loosestrife, a deceptively attractive plant, was spread inadvertently through wildflower seed mixtures. Leaf beetles are being used to control purple loosestrife at Oregon's Basket Slough National Wildlife Refuge.

Gorse is a highly competitive plant with an oily composition that increases the risk of catastrophic fire. The widespread presence of gorse around the coastal town of Bandon, Oregon, was blamed for the town's catastrophic fire at the beginning of the century. Its spiny, prickly nature makes gorse difficult to remove.

Cheatgrass is believed to have been introduced with wheat seed from Europe, but deliberate attempts were also made by governments to use it in vegetating roadsides. Highly competitive with native rangeland plants, it forms dense monocultures and increases fire hazards.

Yellow star-thistle, introduced by beekeepers because it produces abundant nectar, is a prickly inedible plant that is destroying destroy rangelands, recreation sites, and natural areas across the West (Robbins et al. 1940).

English ivy, long a favorite in formal gardens, is extremely aggressive, killing native plants from trilliums to Douglas-firs. It is a particular problem in urban areas, where it was introduced to gardens and has since spread to parks and natural areas.

Himalayan blackberry forms dense impenetrable thickets, generally in disturbed areas. Vigorous, erect canes can grow 20 to 30 feet in one season.

Scotch broom invades disturbed sites such as clearcuts, dredge spoils, and roadside clearings. It produces prolific seed crops and propagates by popping and shooting seeds many feet. It spreads rapidly and out competes native plants.

Knapweed - both diffuse and Russian - is very noxious and invasive.

Other well-known invasive exotic plants include kudzu, Eurasian milfoil, and water hyacinth.

Invasive Animals

Unless otherwise noted, the following was adapted from Kozloff (1976) and Palmer (1975):

European green crabs have invaded the Pacific Coast. The crabs have voracious appetites and potentially threaten native species, including Dungeness crabs, clams, mussels, and oysters (Griffith 1997).

Carp were first introduced to the United States in the 1870s by the secretary of the Smithsonian Institution. They were subsequently widely introduced in lakes and reservoirs, generally for the purpose of consuming oxygen-depleting algae. However, carp are quite destructive, plowing up marsh bottoms when feeding, making water too turbid for the propagation of native plants important to waterfowl, and destroying the nests, eggs, and young of other fish.

Brown trout, first introduced from Europe as a game fish, are now widely established. This aggressive fish causes extirpation of native species. Large brown trout sometimes eat frogs, birds, mice, and other small mammals in addition to aquatic and terrestrial insects.

House sparrows were first introduced to the United States in the 1850s by the president of the Natural Historical Society of Brooklyn. They are aggressive, highly adaptive birds that compete with native birds for nesting cavities.

European starlings were introduced to the United States by an eccentric German emigrant who wanted to introduce all the birds mentioned in Shakespeare's plays. Most introductions failed, but starlings spread so rapidly throughout the United States that within a hundred years of their introduction, they became the most abundant bird species in North America and one of the continent's greatest pests. They eat almost anything and compete with native cavity-nesting birds for nesting sites.

Ring-necked pheasants, native to eastern China and Korea, were introduced as a game species. They may compete with native species, and pheasant propagation-and-release programs drain funds from state management of native species.

Opossums are native to the eastern United States and are now well-established in the West. They eat anything organic and adapt well to city life.

House mice and Norway rats have established themselves almost anywhere that people live. They carry disease, destroy crops, and are a general nuisance.

Nutria, rodents native to South America, were introduced first to the Lower Mississippi in the 1930s to be bred in captivity for their fur. Many escaped during heavy floods or were released into the wild when fur prices dropped. These prolific

creatures spread rapidly through marshy areas, where they compete with native species such as muskrats.

Snails and slugs that are garden pests generally originated in Europe and Asia and were inadvertently imported in nursery stock. They also wreck havoc on agricultural crops (Savonen 1997).

Many garden earthworms were introduced from Europe. Of the introduced species, perhaps the most well-known is the night crawler, commonly sold as fish bait.

Stewardship Principles and Management Recommendations

A number of approaches might be taken to control damage caused by invasive exotic species. However, controlling exotic animals and plants, even if they are causing ecological disruption, is not always necessary or appropriate. Once established, aggressive animals like starlings and opossums are nearly impossible to eradicate, and the effort would not justify its cost. In other cases, techniques for controlling invasive species are not well-developed or could cause more harm than good. For example, although introduced bullfrogs can be killed by electro-shocking the water bodies in which they occur, the process also kills native amphibians and fish.

The most obvious solution to the problems caused by invasive species is to stop introducing them deliberately. Many state fish and wildlife agencies have terminated their exotic game-bird propagation programs and adopted regulations to control the importation of exotic pets that could thrive if released in the wild. However, these agencies still actively stock populations of other exotic game species, especially exotic sport fish.

Several strategies exist for controlling the spread of most of the invasive exotic plants and animals. The following recommendations were taken from the Bureau of Land Management s Action Plan, Partners Against Weeds (1996c). Although specific to weeds, the recommendations are broad enough to be applied to both invasive plants and animals.

Developing an early prevention and detection program is the most practical, economical, and effective means of managing invasive exotics. This includes limiting the introduction of new exotics via seed, feed, grain, hay, straw, and mulch; making sure equipment is clean when moved into uninfested areas; keeping animal furs and fleece free of seeds; using exotic-free gravel, road fill, and soil; and avoiding purchase of contaminated plants and seeds sold by nurseries.

Improving education and awareness, training resource-agency personnel, developing outreach materials for the public, offering recognition for special efforts to identify and control exotics, and incorporating information about exotic species into a variety of broader efforts and programs can serve together to help reduce the exotics problem. Agencies should ensure that adequate baseline data are available on the distribution of exotics and should use cooperative approaches for mapping problem areas, updating them regularly. Resource management plans should include provisions for managing exotics.

Agencies should use an integrated approach to managing exotics and should implement on-the-ground operations. Integrated management is a decision-making process that uses site-specific information to make decisions. It may include cultural, physical, biological, and chemical controls. New biological methods are being used to control exotic plants without using harmful chemicals. For example, purple loosestrife is being controlled in wetland areas by purple-loosestrife-eating beetles and root-mining weevils. These insects will survive and reproduce, so repeated treatments are not necessary. Eventually, the insects should reach many more sites where the plant is found (Indiana Department of Natural Resources 1991). Long-snouted weevils are being used to control Scotch broom (Martinis 1997).

Agency personnel need to ensure that management plans are carried out efficiently and consistently across jurisdictional and political boundaries. Interagency cooperation is essential to success, as are cooperative efforts with the private sector. Actions include training, coordinated funding, and cooperative research.

Sufficient data and standardized monitoring techniques are vital to implementing and evaluating management actions. Agencies also need to develop a reporting system to support early detection and eradication efforts.

Government agencies can undertake several initiatives that will help to enlist citizens in campaigns against exotics. Agencies can increase public awareness by distributing wanted posters that include pictures of the culprits and maps of their distribution. They can organizing volunteers to remove exotic plants from parks and natural areas and ask hikers and campers to report exotic plants in backcountry areas. They can involve scout groups by offering merit badges in return for help in the control of exotic plants or cash rewards for enrolling homeowners in programs to control exotics. Local

governments can organize prison laborers to remove invasive plants from public areas.

More research is needed to determine the most effective long-term strategies for controlling harmful exotic weeds. Simply killing weeds is not enough. More attention must be given to ecological considerations so that control efforts yield healthy and relatively weed-resistant plant communities. This approach requires that managers place more emphasis on encouraging the establishment of desired species after weeds are controlled (Sheley et al. 1996).

Existing and Promising Incentives

Incentives for addressing exotic plant and animal problems should be focused on those problems that can be managed cost effectively. Some potential incentives include:

- Offering a cash reward for early detection of an invasive exotic plant or animal.
- Offering bounty payments for delivery of desired exotic plants or animals.
- Local governmental assistance and cost sharing to homeowners who remove invasive plants.
- Local governments also can adopt regulations that prohibit the planting of invasive exotics in sensitive areas.
- Stewardship certification of nurseries that agree to provide information on invasive exotics, that agree not to sell them, and that stock native plants and promote their ecological benefits.
- Using permissive angling regulations to encourage the harvest of exotic fish and wildlife species.

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Conclusion

The decline of biodiversity has many causes. Millions of small actions taken daily by individuals, businesses, governments, and organizations contribute to the loss of wildlife and habitat, foul the air and water, and modify ecosystems so that they no longer function as they should. Most of these actions are not willfully malicious. People often damage the environment without understanding the implication of their actions, especially the cumulative effects of many small impacts over a long period.

The good news is that the United States is in much better condition ecologically than many other places throughout the world. Vast open spaces abound, and land-use planning has helped confine urban sprawl. Public-land managers have embraced ecosystem management and taken important steps to improve coordination among agencies and with the private sector. Leaders in forestry and agriculture have participated in constructive dialogues with various officials concerning watershed restoration and have contributed in many ways to efforts on the ground. Many people have a strong interest in quality-of-life issues, which include a healthy environment and opportunities for outdoor recreation. But a great deal of work remains to be done to restore damaged ecosystems and to make sure that those in good condition stay that way.

Conserving and restoring biodiversity implies changing the way we live and do business. Some of the changes will be relatively painless and cause minimal disruption of our lives. Others may require more substantive modifications to our activities and institutions. Few of these changes - whether small or large - are likely to take place unless society is motivated to make them. Many of these changes have already been proposed, and some are being implemented by agencies, organizations, businesses, and individuals.

Increased knowledge about ecosystems can lead to improved stewardship. Enhancing educational efforts at many different levels is an important component of any effort to conserve biodiversity and protect ecological integrity. Particularly important is the adoption of lifelong learning as a basic tenet of adaptive ecosystem management. Improving access to credible and consistent information about the overall distribution and management of resources could also streamline natural-resource decision making. More effective monitoring systems are needed to determine whether goals are being met.

Greater efficiency may motivate people who do not necessarily object to the goals of environmental laws, but feel that implementation of regulations is unnecessarily burdensome and complex. Such people are interested in alternative compliance strategies that give them greater flexibility in meeting environmental goals without getting tangled up in red tape.

A large governmental bureaucracy is in place to establish environmental rules and punish those who do not comply. This report has not addressed the rules except to state that they are generally deemed necessary to establish a baseline for environmental performance. However, some believe that we have reached the limits of regulation and need to find other ways to encourage people to protect the environment in general and biodiversity in particular.

One positive aspect of regulations is that they tend to establish a level playing field, requiring the same performance by everyone. Although many state, local, and federal regulations prohibit actions that are harmful to the environment, the vast majority of these regulations have focused on reducing air and water pollution associated with concentrated industrial activities. A growing consensus among government, business, and environmental leaders suggests that the next generation of environmental policymakers will focus on more dispersed activities across the landscape that do not lend themselves to a command-and-control strategy.

We think a much greater commitment to incentives is needed if the United States is to clean up contaminated waterways, remove existing listings, and prevent additional listings under the federal Endangered Species Act. Incentives will not replace environmental regulations, nor should they. To be widely successful, incentives must survive the common-sense test and avoid creating loopholes that produce unintended consequences. While acceptance of incentives will not be universal, we hope this report will stimulate serious discussion in communities across the United States on the need for both a carrot and a stick in environmental protection.

Whether prompted by the carrot or the stick, actions affecting the landscape will need to be undertaken in a more synchronized fashion than has been the case in the past. Random acts of restoration are unlikely to reverse decades of abuse caused by the cumulative impacts of many individuals, businesses, and government agencies. New roles for government and private organizations will need to be defined to help facilitate and coordinate restoration and conservation activities on the ground. Success will also depend on our commitment to establishing appropriate benchmarks and implementing cost-effective monitoring systems to measure our progress so that adjustments can be made when systems fail to produce the desired results. Providing these additional conservation tools will help to engage a broader spectrum of the population in effective efforts to protect our natural heritage.

In the long run, most lasting changes will be made because people believe in the need to leave a legacy to future generations - a legacy that includes healthy wildlife populations, clean air and water, functioning ecosystems, functioning economies based on resource management, and places to go to enjoy the outdoors. People will make changes in the way they live to protect these values only if they understand the changes that need to be made. Good stewardship of natural resources is everyone's responsibility, and given the right incentives, we can all work to make a difference in our own states and across the nation.

National Stewardship Initiatives:
Conservation Strategies for U.S. Land Owners

by Sara Vickerman

APPENDIX A Part I

Financial Incentives

Incentives	Problem Addressed	Mechanics	Cost	Examples	Comments	Refer
1. Estate-tax reform.	Private land often sold or modified upon death of owner, destroying quality habitat.	Exempt owner from estate tax if lands managed to conserve habitat until land is sold or developed.	$4 million annually (endangered species only).	Heirs get tax breaks for farmland if they continue farming.	Requires monitoring. May inspire landowners to manage quality habitat. Need to decide if benefit is deferment or forgiveness.	Keysto Center 1995. OR De Forest 1996. Ferris,
2. Estate-tax concepts for land conservation.	Conservation needs fall disproportionately on some landowners.	Allow heirs to give land to tax-exempt organizations. Offer tax credits for land gifts.	High $1 billion plus.			Keysto Center 1995.
3. Federal tax credits for endangered species management on private land.	Private landowners can't afford to manage endangered species habitat.	Offer tax credits for certain management practices listed or approved by FWS.		Reforestation tax credit, stewardship-incentive program.		Keysto Center 1995. McKin et al. 1 Ferris,
4. Property-tax credit for land with endangered species conservation agreement.	Landowners who protect habitat may be charged high taxes for highest and best use of the land.	Allow federal tax credit (to offset local property taxes) if land is managed for habitat.	Federal treasury-moderate.			Keysto Center 1995. McKin 1994.
5. Deducting habitat-management costs.	Private, non-industrial landowners must capitalize management costs over years.	Allow landowners to take deductions for habitat management annually.	Low.			Keysto Center 1995.

6. Land assessment exchanges.	Some federal lands have low habitat value.	Trade, sell or purchase federal, private lands to protect more quality habitat.	Revenue neutral except transaction costs.	Umpqua land exchange.	Willing seller only. Pools funds from sales to purchase private lands.	Keysto Center 1995. Florida GFWF 1994.
Incentives	**Problem Addressed**	**Mechanics**	**Cost**	**Examples**	**Comments**	**Refer**
7. Endangered species habitat trust fund.	Decreasing acquisition funds and increasing pressure to pay landowners.	Non-profit corporation to complement Interior Land Exchange system.	Neutral.		Goal is to put ecologically significant land in public ownership and maximize return on commercially valuable property.	Keysto Center 1995.
8. Provide financial incentives for riparian protection.	Riparian lands have high ecological and commercial value.	Use state tax credit to cover management costs.				OR De Forest 1996.
9. Cost-share or tax credits for habitat investments.	Private landowners don t want to bear the cost of protecting public values.	Certify income tax credits for landowners participating in watershed councils.	Could be significant.			OR De Forest 1996. Florida GFWF 1994
10. Conserve priority areas using less than full fee techniques.	Land acquired by the government is removed from tax rolls.	Partnerships, easements, land exchanges.		Land trusts, agencies, private organizations do this.		OR De Forest 1996. Yager, 1994. Ferris,
11. Investment fund to finance stewardship projects.	Technology to reduce pollution can be expensive.	Fund applications through competitive grant applications.	Depends on size of fund.	Grants or low interest loans for no-till drills.	Could be difficult to set guidelines and priorities.	Willan River Task F 1997.
12. Insurance program.	Implementing new techniques creates risk.	Public and/or private resources provide insurance against losses in experimental programs.	Moderate.	Insurance for WA apple growers in biological control study.	Reducing risk may improve willingness to try new techniques.	Willan River Task F 1997.
Incentives	**Problem Addressed**	**Mechanics**	**Cost**	**Examples**	**Comments**	**Refer**
13.	Funding is hard to	Consolidate	Could be		Requires state,	OR De

Consolidate funding for federal, state assistance programs.	find and match with priority projects.	programs and channel funds to priority habitat projects.	neutral.		perhaps federal legislation.	Forest 1996.
14. Expand CRP to cover broader habitat values CRP does not cover conservation of older trees, for example.	Authorize payments for specific land management practices.	CRP used for erodable land, expanded to address wildlife habitat.			Federal legislation updated 1996.	OR De Forest 1996. Ferris,
15. Competitive bidding for wildlife habitat.	Now illegal to lease resources and not use them.	Allow leasing public resources for non-use. Permit conservation interests to bid on resources.	Nominal to government.	Private parties bid for extractive uses, why not public uses? Nebraska allows conservation interests to bid on in-stream water for wildlife.	Requires change in Federal law.	Ander 1994.
16. Lease in-stream water.	Water rights unused diverted to other users, often wasted.	Individuals, groups purchase water and leave it in streams.	Nominal.	Oregon Water Trust.	Requires change in some state laws. Some states don't allow in-stream use for wildlife.	Ander 1994.
17. Create market for development rights and sell on open market.	Habitat given greater economic value in marketplace.	Priority habitats identified and conservation needs defined. Private owners awarded development rights to be bought, sold on open market. Non-critical land assigned marketable development rights.	High administrative.	HCP process uses habitat quotas. Air pollution credits.	Complex bureaucratic structure to administer. Based on notion that certain habitat is surplus. Controversial.	McKir et al. 1 Ferris, Florid GFWF 1994.
18. Voluntary	Landowners lack financial	Landowners paid for		Resembles conservation		Bean,

land enrollment approach.	incentives to protect habitat.	certain land management 1. Lands identified 2 . Management defined 3 . Compensation identified from a variety of sources.		reserve and wetland reserve programs.		
Incentives	**Problem Addressed**	**Mechanics**	**Cost**	**Examples**	**Comments**	**Refer**
19. Habitat transaction method for endangered species.	No economic incentive for landowners to conserve habitat.	Land in planning area given conservation value. Credits needed to develop land, and credits gained when land is conserved.	High administrative.	New Jersey Pinelands wetland banking.	Requires precise land, habitat inventory and evaluation. Considers size and shape. Avoids parcel disputes. Legislation required to facilitate, process and address tax issues.	Yager, 1994.
20. Biodiversity trust fund.	Owners of habitat bear expense while society enjoys benefits. Conflict inevitable.	Public and private funds, privately managed, to purchase conservation easements on lands, pay landowners to use certain management practices, or pay landowners to conserve species habitat.	Could be neutral if investment in subsidies re-directed.	Willing sellers. Competitive conservation planning. Access and severance fees.		Baden 1994. O'Too 1994, Ferris,
21. Contracting for conservation.	Private interests may do a better job of recovering species.	Contract habitat or species management to private organizations or companies and pay when recovery targets are met.	Reallocation of money.	Grant management responsibility and exclusive hunting rights to private party.	Some may object to transfer of public assets to private interests.	O'Too 1996.
22. In-kind materials.	Landowners may not be able to afford materials	Agencies, organizations provide	Low.	Provide tree seedlings or fencing	Landowners or non-profits provide labor.	OR De Forest 1996.

	for restoration, habitat improvement.	plants, construction materials.		materials.		
23. Reduce timber excise tax.	Managing for environmental values costs landowners.	Reduce excise tax for owners who adopt desired management practices.	To general fund.		Could also raise tax for landowners who do not adopt desired practices.	K. Joh 1995.
24. Reduce forest capital gains tax	Forest land investments and long rotations not encouraged by existing system.	Reduce forest capital gains tax or index or discount for inflation.			Policy decision re: eligibility for small vs. large landowners.	K. Joh 1995. Ferris,
Incentives	**Problem Addressed**	**Mechanics**	**Cost**	**Examples**	**Comments**	**Refer**
25. Promote value-added forest products economy.	Biodiversity goals and economic goals not closely linked.	Various cooperatives, research assistance to landowners.		Wood Net, Woodcraft Network, WA DNR. Small sales and specialty timber program.		K. Joh 1995.
26. Biodiversity pathway.	Some management for biodiversity is inconsistent with management for timber.	Contracts with landowners in priority watersheds issued on a competitive basis.	Goal is highest benefit, lowest cost.		Landowners need assurance that timber could be harvested eventually.	K. Joh 1995.
27. Conservation reserve program for endangered species.	Landowners lack incentives for managing habitat.	Farmers paid to manage habitat under contracts.	High.	Greater prairie chicken and sharp-tailed grouse helped by CRP.	Modify existing CRP to include more habitats and management techniques.	Keysto Center 1995.
28. Green certification.	Landowners using best management practices may not derive economic benefits.	Certify products raised according to best management practices to increase market value.	To producers.	SmartWood, salmon-safe food.	Economists believe green certification adds value to wood products.	OR De Forest 1996. Pacific Rivers Counc 1997.
29. Provide tax benefits for mandated set-asides.	Land can be taken out of production under ESA, but the landowner pays the cost.	Allow landowners to calculate reduced timber value			May require change in federal tax law.	OR De Forest 1996.

		when land set-aside.				
30. Increase timber liquidity to increase rotation.	Difficult to turn standing timber into cash. Promotes early harvest.	i. Timber futures market ii. Revolving loan fund iii. Create standard process for timber appraisal.	Some public funds needed.	Chicago Board of Trade to open futures market for recyclable materials.		K. Joh 1995.
31. Voluntary tax deferred account created from portion of gross timber harvest receipts to care for land in the future.	Multi-generational/long-term nature of forest investment needs addressed.	Account stays with the land with funds only available for approved stewardship purposes.	Likely high depending on how modified.	Norway Forest Trust system.	Interest from these accounts provides educational/technical assistance to woodland owners.	OR De Forest 1996.

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APPENDIX A Part II

Habitat Conservation Planning

Incentives	Problems Addressed	Mechanics	Cost	Examples	Comments	Reference
1. Habitat conservation plans.	Landowners want more certainty.	HCP approval linked to incidental take permits (ESA).	High.	Weyerhaeuser. State of Oregon.	Controversial. Concern about need for changes in the future.	Peterson, 1997.
2. Streamline HCP process HCP process burdensome, expensive.	Establish low effects HCP process - short form.	Might reduce admin. Costs.	Amend NEPA, ESA to avoid duplication.		Consider cumulative effects.	Keystone Center, 1995. Graham, 1994.
3. Seed money for community-based HCPs.	Local government bears expense of HCP process.	Congress funds local, cooperative efforts to develop HCPs through revolving loan fund, matching grants.	$25 million one-time appropriation.	1992-1994 Congress funded Brevard County in Florida.		Keystone Center, 1995. Florida GFWFC, 1994.
4. No Surprises Policy.	Current HCP process does not provide enough certainty for landowners.	Amend ESA to protect landowners from increasing obligations after HCP approved.		1994 Deptartment of the Interior policy.	Concern about changing conditions and fixed agreements.	Keystone Center, 1995.
5. Cooperative Conservation Planning.	HCP process too complex for many landowner and habitat needs.	Use with rural landowners in agricultural areas. Pool resources. Use habitat credits. Needs technical assistance.			Requires amendment to ESA if focused on endangered species habitat.	McKinney, 1994.
6. Broader	Existing,	Focus planning		Coastal sage	May require	Opdycke,

scale habitat recovery planning.	single endangered species approach too narrow.	on larger areas, multiple species before they get into trouble.		scrub.	amendments to ESA and FACA.	1994.
7. Issue interim incidental take permits.	HCP process takes a long time.	Issue temporary incidental take permits while regional plans are developed.	Admininistrative.		Requires amendment to the ESA.	Bartel, 1994.
Incentives	**Problems Addressed**	**Mechanics**	**Cost**	**Examples**	**Comments**	**Reference**
8. Improve cooperative efforts to restore habitat.	Lack of coordination limits effectiveness of existing programs.	Coordinate federal, local, state, watershed and landowner habitat efforts.				OR Dept. of Forestry, 1996.
9. Improve and standardize inventory and monitoring.	It is difficult to get information about the status and health of ecosystems.	Coordinate agency programs and involve private landowners.		Coordinated resource-management planning.		OR Dept. of Forestry, 1996.
10. Recovery plan incentives.	ESA does not invite landowner involvement in recovery planning, and sometimes surprises them.	Involve private owners in recovery planning and allocates responsibilities among different parties.			Modify ESA. Need interagency approach. Could help identify priority habitat for acquisition.	Keystone Center, 1995.
11. Address anti-trust concerns.	Concerns about anti-trust limits cooperation among private landowners.	Provide info to landowners and change the law, if necessary.	Administrative.		Amend state law requiring agencies to coordinate activities.	OR Dept. of Forestry, 1996.
12. Common procedures for inventory.	Inconsistent information inhibits coordinated management.	State, federal coordination.	Will save money.	Cooperative monitoring evaluation research committee in Washington.	Federal, state statutes may be necessary.	K. Johnson, 1995.
13. Co-location of public infrastructure corridors.	Unnecessary habitat loss.	Comprehensive planning.	Will save money and habitat.		Should avoid sensitive areas.	Florida GFWFC, 1994.

14. Long term management and use agreements.	Lack of ability for landowners to plan for the future.	Coordinated permit review, incentives, density bonuses.		HCPs.	Purpose to establish commitments of landowners and government to conservation.	Florida GFWFC, 1994.
Incentives	**Problems Addressed**	**Mechanics**	**Cost**	**Examples**	**Comments**	**Reference**
15. Mitigation agreements.	Existing mitigation too rigid. Narrow, limited ecological benefits.	Focus on ecosystems, accept reclamation as mitigation, establish fund for off-site mitigation purchases of priority areas.	To developers no change.		Expand traditional concept.	Florida GFWFC, 1994.
16. Develop stewardship incentives programs for all sectors.	Only available in forest sector. Underfunded.	Agencies work with landowners, provide technical assistance.	Staff, program admininstration.	Forest stewardship incentive programs.	Existing programs under-funded.	Florida GFWFC, 1994.

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APPENDIX A Part III

Streamlining Regulations

Incentives	Problems Addressed	Mechanics	Cost	Examples	Comments	Referen
1. Pre-listing conservation agreement.	Landowners see endangered species as liabilities.	Voluntary actions to conserve species in return for regulatory relief for landowners.	Administrative.		Landowner protection should carry over if species is listed later.	Keystone Center, 1995.
2. Safe harbors.	Landowners see endangered species as liabilities.	Landowners protect unoccupied endangered species habitats in return for permission to modify habitat in the future.	Limited.	1995 NC Sandhills HCP.	Habitat may be temporary. Notification required before habitat modified.	Keystone Center, 1995. Florida GFWFC, 1994.
3. "No take" cooperative agreements.	Landowners with endangered species habitat fear prosecution under taking provision.	Landowners protect habitat under management plans developed with FWS in return for management certainty.	Administrative.		Some binding agreements may be necessary to ensure compliance.	Keystone Center, 1995.
4. Guidance to landowners at the time of listing.	Landowners unclear what constitutes taking of endangered species.	Federal register notice contains info concerning specific activities and impact on "taking." Also list of disincentives and recommendations for eliminating them.	Administrative.		Would help landowners plan and manage lands and focus on eliminating disincentives.	Keystone Center, 1995.
5. Increased regulatory flexibility.	No incentive for landowner to downlist,	Permit management flexibility for	Administrative.		Congress makes clearer distinction	Keystone Center, 1995.

	delist endangered species.	threatened species.			between threatened and endangered species.	
6. Streamline regulatory process for wetland projects.	Two layers of bureaucracy for wetland projects inhibit activity.	Give fish and wildlife agency authority to issue fill and removal permits for habitat projects.	Could save money.			OR Dept. Forestry, 1996.
7. Simplify regulations for certified good managers.	Many regulations are complex and expensive relative to conservation benefits.			Stewardship agreements.		OR Dept. Forestry, 1996.
Incentives	**Problems Addressed**	**Mechanics**	**Cost**	**Examples**	**Comments**	**Referen**
8. Limit liability for habitat-improvement work.	Leaving snags, stream improvements can cause hazards and expose landowners to liability.	Seek statutory limits for liability for certain habitat improvements.	Nominal.	Snags are often removed for safety reasons. Prescribed burning difficult.		OR Dept. Forestry, 1996. Florida GFWFC, 1994.
9. Tradable credits for endangered species habitats.	Landowner incentives to protect endangered species habitat don't exist.	Take authorized with 2:1 mitigation requirement dropped to 1:1 when goals met. Landowners can trade or sell rights.	High admininistrative.	Red-cockaded woodpecker colonies in NC.	Will require intensive survey and monitoring-authority now exists.	Bean, 199 Schaerer, 1996.
10. ESA Section 7 blind trust fund.	Delays in endangered species consultations cost landowners money.	Establish "blind" trust fund with private money to pay for timely consultations.	None to government.		Changes in ESA and regs may be required.	Yager, 1994.
11. Issue long-term management permits.	Landowners need certainty.		Administrative.	HCP.	Permits 10-15 years in return for exemption from new regs.	K. Johnso 1995.
12. Different permits for sensitive sites.	Permit requirements too stringent for sites of	General permits, exemptions, less restrictive permits for low-	Administrative.		Purpose is to focus regulatory effort on high	Florida GFWFC, 1994.

	lesser value, too lax for important areas.	priority sites.			priority areas.	
13. Eliminate regulatory disincentives for voluntary exotic removal and habitat enhancement.	Regulatory barriers discourage habitat improvements.	Expedited permit or waiver process.	Low.	Landowners need permits to enhance wetlands, build ponds.		Florida GFWFC, 1994.
14. Integrate habitat management plans into reg. review.	Landowners see contradictory, duplicative requirements.	Federal, state, local regs should be included.	High coordination costs.		Should encourage adoption of habitat plans.	Florida GFWFC, 1994.
Incentives	**Problems Addressed**	**Mechanics**	**Cost**	**Examples**	**Comments**	**Referen**
15. Encourage landowners to do no-penalty env. surveys and audits.	Landowners fear penalties will result if problems are found.	State could offer assistance.	Audit costs.		Should encourage voluntary actions.	Florida GFWFC, 1994.
16. Green planning.	Prescriptive regulations do not always generate best results.	Economic sectors establish goals and are exempt from regulations as long as they are met.	Should be cost effective.	Netherlands, New Zealand.	Oregon exploring options.	H. Johnso 1995.

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APPENDIX A Part IV

Revenue for Incentive Programs

Incentives	Problems Addressed	Mechanics	Cost	Examples	Comments	Reference
1. Create budget squad to kill subsidies. Use money for biodiversity debt reduction.	Federal subsidies encourage habitat destruction.	Budget squad has authority to impound funds from federal programs that harm species.	Redirect $200 million each year.		Would reduce threats, fund biodiversity, reduce deficit.	O'Toole, 1997.
2. Tax penalties for habitat conversion.	Insufficient funding available for incentive programs. Economic costs associated with habitat destruction not paid by users.	Per-acre tax on significant habitat converted to other uses.	Hundreds to thousands per acre to landowners.	Similar to concept of pollution taxes and fees.	Would require extensive surveys to identify taxable habitat.	McKinney, 1994.
3. Impose fees on damaging activity.	Biodiversity value not reflected in markets.	Identify priority areas. Set fees appropriate to biodiversity value.	Could generate revenue.		Need formula for assigning biodiversity value to land. Works best in large planning area.	Reid, 1994. Ferris, 1996. O'Toole, 1994.
4. Paving tax.	Creating impermeable surfaces harms habitat.	Tax "paving" of private lands. Use funds for conservation.	To developers, industry, homeowners.			O'Toole, 1997.
5. Biodiversity trust fund.	Insufficient funding for conservation	Funding from public and private	Could be neutral if subsidies	Private conservation organization.	Funding from extractive uses and	Schaerer, 1996. O'Toole,

	programs.	sources to purchase land, easements, contracts, management, administered by board.	redirected.		recreational user fees.	1994.
6. Recreational user fees on public and private land.	If only extractive uses generate revenue, they will remain dominant.	Collect fees for rec. use, and use funds to manage lands.	To users, guides.	Fee hunting on private land.	May limit access for low income users, pilot program in place on federal lands.	Schaerer, 1996. O'Toole, 1996.
7. Real estate transfer fee.	No money for incentive programs.	Federal real estate transfer fee.	0. 1% could raise $300 million annually.		Requires legislation.	Goldstein, 1994. Ferris, 1996. O'Toole, 1997.

Technical Assistance

Incentives	Problems Addressed	Mechanics	Cost	Examples	Comments	Reference
1. One-stop shopping for technical assistance.	It is difficult and time consuming for landowners to seek advice from many agencies.	Establish multi-agency tech teams to help landowners take a holistic approach.	Could be neutral.		Complicated to fix the problem.	OR Dept. of Forestry, 1996.
2. Stewardship planning.	Landowners may not realize habitat value of their property or know how to manage it.	Direct contact with landowners in priority areas-assistance with conservation planning.	Labor intensive.			OR Dept. of Forestry, 1996.
3. Technical assistance.	The Endangered Species Act seen as punitive. Technical assistance more local, positive.	Information, dollars, materials and other assistance to landowners. Includes agency coordination. Voluntary toll-	Could be substantial.	Prairie chicken viewing opportunities SW Missouri, money for landowners.	Keystone Report says it needs to be flexible, local. Needs to be evaluated. Could also be national or state technical assistance	Keystone Center, 1995. Ferris, 1996.

		free number. Help capitalize on wildlife.			programs.	
4. Endangered Species Act Section 6 grants to states for technical assistance.	States lack funding to help landowners.	Grants to states for monitoring, education, technical assistance in priority areas.	Moderate.			McKinney, 1994.
5. Assist landowners with ecosystem approach.	Single species approach does not prevent future problems with other species.	Technical assistance with habitat approach.	Moderate.	Partners for wildlife. USFWS.		Florida GFWFC, 1994.
6. Create commodity commission.	Small landowners need help with scientific, economic, technical challenges.	Assessment on timber harvest funds landowner-assistance programs to implement sustainable forestry.	None to the taxpayer.	Oregon Forest Resources Institute.	Could be matched with public funds with certain expenses.	K. Johnson, 1995.

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APPENDIX A Part V

Exchange Agreements

Incentives	Problems Addressed	Mechanics	Cost	Examples	Comments	Reference
1. Stewardship exchange agreement.	Priority habitats (wetlands) often on private lands.	Specific conservation measures on private land exchanged for management and use privileges on public lands.	Administrative. Some lost revenue.	Protect riparian on private land for forage on public land.	Exchange includes long-term stewardship responsibilities.	Otley, 1996.
2. Land swaps.	Landowners object to taking of development rights on sensitive lands.	Trade public land with low ecological value for private land with high ecological value.	Administrative by public or private interests.	Aerojet General traded Florida endangered species habitat for land in Nevada.	Potential benefits to conservation and landowners.	Schaerer, 1996.
3. Private ownership of species.	No financial incentive for private interests to conserve species.	Transfer ownership of species or habitat to private interests in return for exclusive hunting or fishing rights.			Political resistance expected.	O'Toole, 1997.

Special Recognition

Incentives	Problems Addressed	Mechanics	Cost	Examples	Comments	Reference
1. Publicize innovative approaches.	Landowners often don't get credit for	Encourage media to cover	Administrative.		Some landowners don't want	OR Dept. of Forestry, 1996.

	improving or restoring habitat.	successful projects.			recognition.	Ferris, 1996.
2. Recognition/Award program.	Endangered Species Act doesn't recognize voluntary actions.	Feds provide plaques, certificates, financial assistance.	Low.	Founders of the New Northwest Awards, Wisconsin certificate of recognition.	Emphasizes positive rather than negative. Enhances relationship between government and landowners.	Keystone Center, 1995. Yager, 1994. Florida GFWFC, 1994. Sustainable NW, 1997.
3. Green certification.	Landowners using best management practices may not derive economic benefits.	Certify products raised according to best management practices to increase market value.	To producers.	Smart wood, salmon-safe food.	Economists believe green certification adds value to wood products.	Granatstein, pers. com. 1997.
4. Heritage stocks designation.	Local communities need better recognition for managing streams with healthy fish stocks.	Erect signs, sponsor ceremonies to celebrate healthy stocks.	Nominal. Oregon trout heritage stocks program.	Not fully implemented.	Pampush, 1995.	

Information Management

Incentives	Problems Addressed	Mechanics	Cost	Examples	Comments	Reference
1. Adopt one natural area's inventory system and support it.	Conflicting databases among agencies create confusing expectations of landowners.	Select best system and use consistent approach, make info widely available to all partners.	Could save money.	US Bureau of Census uses same techniques throughout US.	Significant barriers, turf, history, technical.	Florida GFWFC, 1994.

Educational Programs

Incentives	Problems Addressed	Mechanics	Cost	Examples	Comments	Reference
1. Educational assistance.	Landowners may not be aware of habitat-management techniques and regulatory options.	State, federal agencies, private organizations.	Moderate.	US Fish and Wildlife Service, Extension outreach.		OR Dept. of Forestry, 1996.
2. Adaptive management.	Landowners skeptical about research, monitoring by agencies.	Involve landowners in goal-setting, monitoring, adaptive management.	Administrative.	Watershed councils.	Programs will have more support if landowners are involved.	OR Dept. of Forestry, 1996.
3. Educate landowners about existing incentives.	Landowners may not be aware of tax and other incentives to conserve habitat.	Conduct seminars.	Moderate administrative.	Oregon CRMP task group compiles info on incentive programs.	Oregon Master Woodland program.	OR Dept. of Forestry, 1996.
4. Computer software for ecosystem management.	High cost of technical expertise.	Develop, distribute software for land managers.	Low.	University of Washington Landscape Management System under development.	Must be practical for all users.	K. Johnson, 1995.

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APPENDIX B

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Steering Committee

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Thomas Imeson and Terry Flores, PacifiCorp
Catherine Macdonald, The Nature Conservancy
Fred Otley, cattle rancher
Howard Sohn, Sun Studs, Inc.
Sara Vickerman, Defenders of Wildlife

Science Committee

Duane Dippon, Bureau of Land Management
Craig Groves, The Nature Conservancy
Larry Irwin, National Council for Air and Stream Improvement
Willa Nehlsen, U.S. Fish and Wildlife Service (formerly with Pacific Rivers Council)
Reed Noss, consultant
Janet Ohmann, U.S. Forest Service
David Perry, Oregon State University

Jim Rochelle, Weyerhaeuser Co.
Mark Stern, Oregon Natural Heritage Program
Tony Svejcar, U.S. Agricultural Research Service

Implementation Committee

Ed Backus, Interrain Pacific
Hugh Black, U.S. Forest Service
Jim Brown, Oregon Department of Forestry
Paula Burgess, Governor's Office, Natural Resource Policy
Jody Calica, Confederated Tribes of Warm Springs
Martin Goebel, Sustainable Northwest
Steve Gordon, Lane Council of Governments
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Dan Bottom, Oregon Department of Fish and Wildlife, Corvallis, Oregon
Peter Brussard, University of Nevada, Reno, Nevada
Dave Buchanan, Oregon Department of Fish and Wildlife, Corvallis, Oregon
Stephen Caruana, Pacific Rivers Council, (now consultant) Eugene, Oregon
Bill Chambers, Stahlbush Island Farms, Corvallis, Oregon
Don Clemans, Oregon Golf Course Superintendents Association, Bend, Oregon
Allen Cooperrider, U.S. Fish and Wildlife Service, Ukiah, California
John Creighton, Harwood Group, Boulder, Colorado
Brad DeVries, Sustainable Agriculture Coalition, Washington, D.C.
Peter Donovan, Wallowa Resources, Enterprise, Oregon
Wayne Elmore, Bureau of Land Management, Prineville, Oregon
Keith Euhus, Weyerhaeuser, Springfield, Oregon
Jay Gibbs, Natural Resources Conservation Service, Heppner, Oregon
Jesse Goodling, Heron Lakes Golf Course, Portland, Oregon
David Granatstein, Washington State University Extension Service, Wenatchee, Washington
Stan Gregory, Oregon State University, Corvallis, Oregon
Steve Gretzinger, Rogue Institute of Ecology and Economy, Ashland, Oregon
Ann Hanus, Oregon Department of Forestry, Salem, Oregon
Susan Holtzman, Forest Service, Portland, Oregon
Mike Houck, Portland Audubon Society, Portland, Oregon
Larry Irwin, National Council for Air and Stream Improvement, Stevensville, Montana
Randy Kautz, Florida Game and Freshwater Fish Commission, Tallahasee, Florida
Steve Kennett, Oregon Department of Fish and Wildlife, Portland, Oregon
Ron Klein, Metropolitan Service District, Portland, Oregon
Heather Langford, Mineral Policy Center, Washington, D.C.
Pete Lavigne, For the Sake of the Salmon, Milwaukie, Oregon
Leslie Lehmann, Oregon Forest Resources Institute, Portland, Oregon
Michele Leslie, The Nature Conservancy, Arlington, Virginia
Marc Liverman, National Marine Fisheries Service, Portland, Oregon

Gary Lynch, Oregon Department of Geology and Mineral Industries, Albany, Oregon
Scott and Catherine Mater, Mater Engineering, Corvallis, Oregon
Janet McLennan, Oregon Fish and Wildlife Commission, Portland, Oregon
John McMahon, Weyerhaeuser Company, Tacoma, Washington
Bob Meinen, Oregon Parks and Recreation Department, Salem, Oregon
Neal Middlebrook, Bureau of Land Management, North Bend, Oregon
Steve Miller, Wisconsin Department of Natural Resources, Madison, Wisconsin
Joe Misek, Oregon Department of Forestry, Salem, Oregon
Claire Montgomery, Oregon State University, Corvallis, Oregon
Frank Morse, Morse Brothers, Tangent, Oregon
Jim Myron, Oregon Trout, Portland, Oregon
Jeff Nickel, Audubon Society of New York, Selkirk, New York
Tom O'Neil, Oregon Department of Fish and Wildlife, Corvallis, Oregon
Randal O'Toole, Thoreau Institute, Oak Grove, Oregon
Kerry Palermo, USDA Forest Service, Reedsport, Oregon
Rich Recker, Oregon State University, Sustainable Forestry Partnership, Corvallis, Oregon
John Reid, Pacific Forest Trust, Boonville, California
Mike Scott, University of Idaho, Moscow, Idaho
Jim Sjulin, Portland Parks and Recreation, Portland, Oregon
Kent Smith, McCollum Associates, Sacramento, California
Steven Smith, Oregon Department of Fish and Wildlife, Corvallis, Oregon
Louise Solliday, Governor's Natural Resources Office, Salem, Oregon
Barte Starker, Starker Forests, Corvallis, Oregon
Bianca Streif, Natural Resource Conservation Service, Portland, Oregon
J.B Summers, Norpac Foods, Stayton, Oregon
Tony Svejcar, USDA Agricultural Research Services, Burns, Oregon
John Tappeiner, Oregon State University, Corvallis, Oregon
Ray Temple, Oregon Department of Fish and Wildlife, Portland, Oregon
Jim Wigington, Environmental Protection Agency, Corvallis, Oregon
Martin Wistisen, AgriNorthwest, Tri Cities, Washington
Mike Wolf, Oregon Department of Agriculture, Salem, Oregon
Bill Young, Oregon Department of Environmental Quality, Portland, Oregon
Jill Zarnowitz, Oregon Department of Fish and Wildlife, Portland, Oregon

National Stewardship Initiatives:
Conservation Strategies for U.S. Land Owners

by Sara Vickerman

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