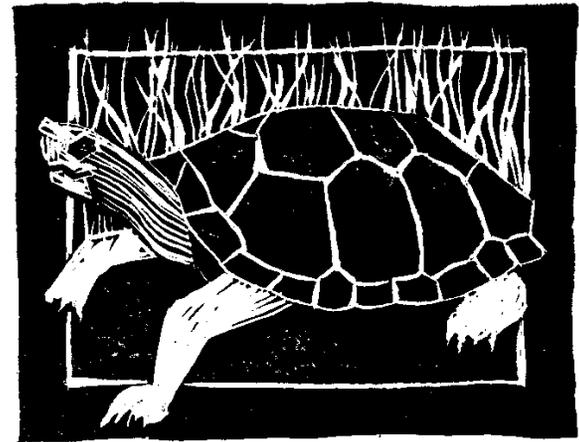
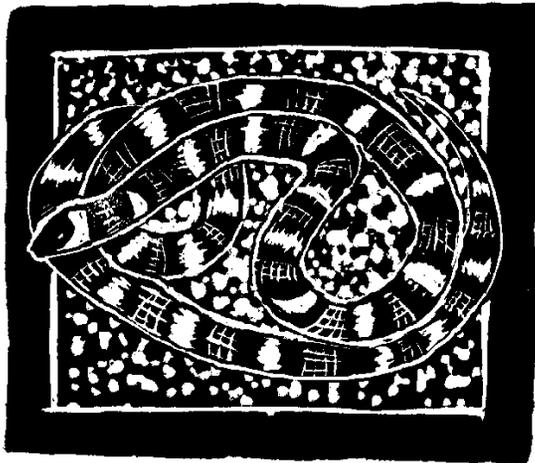
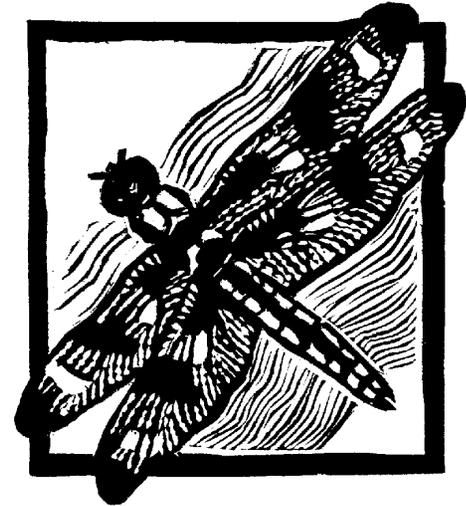


STEWARDSHIP INCENTIVES

CONSERVATION STRATEGIES FOR OREGON'S WORKING LANDSCAPE



BY SARA VICKERMAN



DEFENDERS OF WILDLIFE

WE GRATEFULLY ACKNOWLEDGE
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LAIRD NORTON ENDOWMENT FOUNDATION
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DEFENDERS OF WILDLIFE



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ABOUT THE OREGON BIODIVERSITY PROJECT

The Oregon Biodiversity Project, initiated and managed by the West Coast Office of Defenders of Wildlife, is a collaborative public/private partnership formed to develop a statewide strategy for conserving Oregon's biological resources. Project staff and partners agree that since many of the state's best wildlife habitats are maintained on private lands, an effective strategy must address the needs of private landowners. Project partners also recognize the importance of developing cross-boundary ecosystem management programs across the landscape. Project operations are overseen by a six-member steering committee composed of conservation and industry leaders. They include:

Daniel D. Heagerty (Chair)
Thomas Imeson, Terry Flores
Catherine Macdonald
Fred Otley
Howard Sohn
Sara Vickerman

David Evans and Associates
PacifiCorp
The Nature Conservancy
Eastern Oregon cattle rancher
Sun Studs, Inc.
Defenders of Wildlife

ABOUT DEFENDERS OF WILDLIFE

Defenders of Wildlife is a national, non-profit organization with headquarters in Washington, D.C. Its 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.

Additional copies of this report can be obtained from the West Coast Office of Defenders of Wildlife. An order form for this publication and other products can be found at the back of the book. Defenders also publishes another version of this report that is tailored specifically to a national audience. To see a copy of that publication, visit Defenders' website at www.defenders.org.

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EXECUTIVE SUMMARY

This report is a product of the Oregon Biodiversity Project, which is one of the first attempts in Oregon to look holistically at natural resources statewide and begin developing a long-term conservation strategy. Although the project initially focused on the identification of habitats that are not well-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 that represent Oregon's biological heritage. Many of the state's plants and animals exist in the managed landscape, and 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.

The report is based on extensive research and discussions with a diverse group of landowners, resource agency personnel, scientists, and conservationists. Its purpose is to analyze a wide range of options for improving stewardship across the landscape. It defines biodiversity broadly to include the long-



term maintenance of genetic resources, native species of plants and animals, habitats and landscapes along with the ecological processes that contribute to overall ecological health. The report also looks broadly at a range of incentives derived from the assumption that people are motivated by many different things in addition to money, including recognition for good deeds, enhanced knowledge about natural resources and restoration strategies, and an opportunity to play an important part in a larger effort to protect resources for future generations.

The incentive options highlighted in the report were selected according to criteria suggested by the Oregon Biodiversity Project's implementation committee (see Appendix B). Effective incentive programs should meet conservation needs in a cost-effective way. They should be easy to administer and understand, and be acceptable to the target audience, primarily private landowners. They should also be flexible, since one size does not fit all. A good incentive program encourages people to begin making improvements in resource management and to receive credit for making progress even if

perfection is not reached. Management for biodiversity values should be viewed along a continuum, rather than an either/or status of protected and unprotected lands. Most lands will not be managed with conservation as a primary goal, but can still make important contributions to biodiversity.

Some of the best incentive options that emerged from this review include the creation of statewide and regional stewardship councils and stewardship certification for different sectors of society. The report also identifies opportunities to encourage improved land management through tax reform, highlighting federal estate taxes and a new program in Oregon that offers reduced property taxes to landowners with approved wildlife habitat plans. Better information for conservation planning, including clear goals, effective monitoring systems, and more technical assistance would help people determine how to manage lands for the greatest environmental and social benefits.

In establishing an incentive program, it is necessary to define what activities will be rewarded and encouraged. Many existing and proposed incentive programs focus narrowly on certain activities (like pesticide use), land uses (like forestry) or benefits (like conserving endangered species).

Although this report recognizes the value of any incentive that encourages improved management, it proposes a broader

approach emphasizing the importance of actions taken by all of us—private landowners, government agencies, businesses, scientists, and others.

Directing residential and industrial development to restricted areas to save open space, and using some lands for intensive agriculture and forestry to spare wildlands from intrusive activities are legitimate approaches to conservation. However, zoning alone is not sufficient to conserve biodiversity. It should not be necessary, and it is probably inappropriate, for the public to finance high-density development and intensive farming and forestry operations—at least not for biodiversity purposes. Incentives financed by the public sector should be used to offset expenses and minimize risk to landowners and managers who are willing to adopt more biodiversity-friendly, less intensive practices even though they may cost money to implement and reduce income. In the long run, the most economically viable incentives are the ones that are market-based, allowing business interests a good return on their investments for providing products and services with positive environmental effects.

In reviewing recommended management strategies, some themes emerged that apply to all land uses, ranging from farm lands and suburban gardens to golf courses and commercial forest lands.

These include:

- conserve soil to support plants and animals;
- conserve water to permit the survival of aquatic organisms;
- avoid contaminating waterways with nutrients and toxic substances;
- control the spread of harmful invasive exotic organisms;
- encourage the use of native or native-compatible plants and animals;
- protect special habitats like wetland, floodplain, and riparian systems.

Effective implementation of these strategies will require integrating planning and information management at multiple scales—from the sub-watershed to statewide, national, and even international levels.

A much greater commitment is needed if Oregon is to meet its goals to restore salmon, clean up contaminated waterways, and prevent additional listings of endangered species. Many federal, state, and local regulations already exist that prohibit actions that harm the environment. Although they have been successful in many cases, regulations have generally not inspired people to take positive actions. Incentives are needed to help individuals, companies and public land managers voluntarily meet a higher standard. In some cases, the simple removal of disincentives will be enough. Providing additional conservation tools will help 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, healthy resource-based economies, 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 what changes need to be made. If our friends, relatives and business associates also recognize the importance and participate in conservation efforts, our chances of success will be even greater. Good stewardship of our natural resources is everyone's responsibility, and given the right incentives, everyone can play an important part in the effort.

INTRODUCTION

OREGON BIODIVERSITY PROJECT

In 1993, a small group of conservationists, frustrated with single-species and crisis-oriented management of complex natural resource issues, decided to try a new approach. The Oregon Biodiversity Project was conceived. It was based on the assumption that it would be productive to evaluate the overall distribution of species, habitat types, land ownership and management strategies across the Oregon landscape to determine which areas should receive the highest priority for conservation. This broad approach is sometimes called a “coarse filter,” which contrasts with the more traditional “fine filter” approach used to protect rare species and single sites.

New tools for conservation planning, principally computer-based geographic information systems (GIS), offer efficient ways to collect, process and analyze voluminous scientific data. Even better, the results are displayed clearly on maps. The ability to summarize and view alternative approaches would facilitate the collaboration of diverse interests, who could then focus discussion about important resource allocation



and management decisions on factual information rather than just ideology.

The first meeting of the Oregon Biodiversity Project’s science committee featured a presentation summarizing research that had looked at alternative

interpretations of species distribution maps. A handful of relatively small, colored hexagonal shapes appeared on a map of Oregon, which was otherwise blank. The shapes represented areas of “species richness” in different combinations. Presumably, the computer could be used to determine which places would capture the greatest number of species, and reserves could then be established to protect them.

But what about the rest of the state? How much land would be required to conserve all terrestrial vertebrate species, and how should it be managed? How do the ecosystems in these and other landscapes function? What disturbances and changes had taken place over time? How accurate were the predictions about species distributions? Who owns the land in question, and would owners be interested in having their land become one of the state’s conservation priorities?

The questions seemed insurmountable. Nonetheless, we recognized that land allocation and management decisions are made every day in the face of uncertainty and would continue to be made with or without the help of a statewide overview. We concluded that however imperfect it might be, a compilation and analysis of major elements of biodiversity statewide would help decision-makers take a broader view, and perhaps get ahead of some endangered species crises not yet evident.

We also concluded that a simple reserve strategy was not enough. The “managed landscape”—where people live, play, farm, harvest trees and engage in other activities—is important, too. Small decisions made by all those millions of people every day will ultimately determine what happens to the natural world.

Although environmental and land use regulations have been important, and will continue to provide protection of natural resources, more is needed. People must understand how ecosystems work, and they must have a strong desire to conserve them. People in local communities must be directly involved in decisions that affect them and their livelihood. Environmental activists must gain a better understanding about what motivates people to manage lands in certain ways, and what it might take to encourage people to adopt improved stewardship practices where problems exist. Voluntary actions will be an important part of an overall conservation strategy. People in all parts of the state—urban and rural—will have important roles to play.

And so the focus of the Oregon Biodiversity Project expanded to include an investigation of incentives, financial and otherwise, since people are motivated by things other than money. It also expanded to consider the practical meaning of stewardship. What actions need to be taken on the landscape to protect biodiversity and to maintain sustainable ecosystems? The answers are not simple, but the questions are important.

The Oregon Biodiversity Project was never intended to offer the last word on these subjects. However, we hope this report will advance the discussion beyond the traditional focus on single species and nature reserves.

LAND MANAGEMENT CLASSIFICATION SYSTEM

When the project was first initiated, staff intended to rely on a four-level land management classification system developed by the Gap Analysis Program—a national program identifying unprotected areas of biological significance across the nation. At one end of the spectrum were lands managed for biodiversity, and having some level of statutory protection. At the other end were private lands, available for resource extraction or development. While somewhat useful, the four-level scheme had a major shortcoming: when the high and low categories were combined, the entire landscape tended to be categorized in black or white terms—protected or unprotected. Private interests and federal agencies associated with the project objected to the implication that the only lands supporting elements of biodiversity were reserves and wilderness areas.

A system was needed to show a wider spectrum of land uses and to demonstrate that the managed landscape currently supports a range of biodiversity goals.

Accordingly, the Oregon Biodiversity Project created a new system for classifying lands on a 10-point scale. Lands at the higher end of the scale (8-10) are managed primarily for biodiversity or natural values, committed to long-term conservation, substantial in size, and have relatively high ecological integrity. Land at the lower end of the scale (1-3) are generally in urban, industrial or other intensive human uses. Lands rated in the middle of the scale (4-7) include farm, forest and range lands managed primarily for commodity production, but still making some significant contributions to biodiversity.

Although the Oregon Biodiversity Project used this 10-point scale to rate only public lands (with the exception of The Nature Conservancy's preserves) for its analysis, the classification system can be applied to any lands. Most private lands, like most public lands, would fall somewhere in the middle of the scale. Modest efforts to improve biodiversity on these lands across the landscape could result in large gains given the number of acres represented.

For the purpose of this report, the classification scheme is useful primarily as a concept to help to place different land uses and variations in management practices within a continuum based on their contributions to biodiversity conservation. Inherent in the concept is the idea that every piece of

land contributes to biological diversity, and all land owners and resource managers can contribute to biodiversity conservation. Some tracts of land may offer different habitat values at different times of the year and the potential exists to enhance those values seasonally.

The classification scheme points out where implementation of some of the management recommendations outlined in subsequent chapters might, for example, move a particular piece of land from a 4 to a 6 on the 10-point scale.

To the extent that private as well as public lands were classified and mapped with this system, it would be possible over time to track improvement or decline in management for biodiversity across the landscape. Further development and refinement of this concept could provide a useful tool for monitoring and assessing the effectiveness of conservation strategies.

OREGON'S CHALLENGE

Oregon's landscape is still relatively undeveloped compared to many areas of the world. Nevertheless, the landscape and its associated native plants and animals have been profoundly affected by human activities in the last two hundred years. Many of Oregon's native habitats have been reduced to a fraction of their historic extent. For example, Columbia Plateau grasslands now cover less than one quarter of the area occupied in the late 1800s. Much of the Willamette Valley has

been converted to agriculture and urban development, and the native prairies and oak savannas that once dominated the landscape have been reduced to isolated fragments. Similar changes are apparent in virtually all of the interior valleys, which were historically dominated by grass lands and gallery riparian forests and woodlands. Ponderosa pine habitats, once widespread on Oregon's east side, have been significantly modified by timber harvest, fire suppression, and disease. Wetlands and riparian habitats show major declines in all ecoregions of the state.

Nearly a quarter of Oregon's native terrestrial vertebrate wildlife species are considered at risk (sensitive, threatened, or endangered) by the Oregon Department of Fish and Wildlife. Many stocks of native salmon and steelhead are in jeopardy, prompting the state to undertake a major effort to restore the most endangered runs.

The causes of these habitat and species declines are many. The principal threats to biodiversity are habitat loss, fragmentation, and degradation. Major contributing factors include the pollution of water, air and soil; introduction of aggressive non-native plant and animal species; increased spread of disease in stressed ecosystems and monocultures; altered hydrology regimes; urban development; and, over exploitation and inefficient use of resources. Most of these activities transcend boundaries of public and private land, and are best addressed from an ecosystem perspective.

Two of the traditional mainstays of environmental protection—regulatory systems and government land acquisitions—have had some notable successes, but are generally hampered by serious drawbacks or weaknesses. Although laws and regulations have been effective in reducing point sources of air and water pollution, they are much less likely to be effective in modifying non-point sources and the activities of individuals across the landscape. Regulations provide a useful base of resource protection, but are less useful in addressing site-specific conservation needs, particularly on private lands, and they do not necessarily inspire people to do more than the minimum required by law. Overall, regulations tend to be more effective in discouraging negative activities and less effective in encouraging positive actions. As for land acquisitions, governments will never be able to afford to purchase all the lands important for biodiversity, and even if they could, public ownership is no guarantee that lands will be managed for conservation.

In short, conservation cannot be the responsibility of government alone. Conservation is everyone's responsibility, and people are more likely to make it their personal priority if they are encouraged, rather than compelled. A more constructive approach to conservation is to put in place, alongside traditional approaches, a strong system of incentives. Incentives come in many forms. They can range from something as simple as public recognition to something as broad as financial incentives. It is this diversity of possibilities, this creativity of action, that

promises to bring out the best in people and help them to become better stewards of the land and its resources. For conservation to be successful, the day-to-day efforts of public resource agencies must be supplemented by greater voluntary action on the part of private landowners and ordinary citizens. Governments cannot—and shouldn't try to—do it all, but they can provide the means to help individuals and communities play a more willing role in the stewardship of the land.

MEETING THE CHALLENGE

This report offers a range of incentives and management recommendations for biodiversity conservation on lands managed primarily for commodity production and other human uses, rather than for their natural values. These managed lands, and the landscape in which they occur, have a profound influence on the state's biological resources. While most of the document is specific to Oregon, much can be extrapolated to situations elsewhere.

The report is a companion document to the *Oregon's Living Landscape: Strategies and Recommendations for Conserving Biodiversity* (Oregon Biodiversity Project, 1998), the Oregon Biodiversity Information System (extensive data sets on various features of Oregon's biodiversity), and other products and services provided by the Oregon Biodiversity Project. The project, discussed in this section, is a private-sector based initiative to produce a statewide strategy for conserving Oregon's native biological diversity.

The report's primary audience is private landowners, resource managers, policymakers and others interested in facilitating biodiversity conservation on the managed landscape.

This report:

Provides a broad range of incentive options that now exist or could be implemented to encourage improved stewardship across the landscape.

Describes specific strategies to enhance biodiversity on lands managed primarily for human uses.

Defines a positive role for private landowners to conserve biodiversity, highlighting the contribution they often already make.

A discussion of conservation incentives is not new; nationwide, numerous groups have organized such dialogues, usually with an intent to identify incentives acceptable to a broad range of participants. The disadvantage of such a consensus process is to eliminate some meritorious options from consideration. This report presents a broad range of options for which readers are invited to weigh the merits.

As a companion document to *Oregon's Living Landscape*, this report focuses on the State of Oregon. However, the principles pertaining to land management practices and the range of incentive options discussed are derived from experiences in

other states and regions, and therefore, are applicable beyond Oregon's borders. Also, some of the existing and proposed incentives involve federal funding or authorization, and would generally apply across the nation.

The definition of an incentive for the purpose of this report is fairly broad. 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.

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.

However, the report does *not* address market-based incentives that apply to industrial processes, like pollution trading and discharge fees. These incentives have typically been applied within a regulatory context. Although reducing pollution and streamlining manufacturing affect biodiversity, analysis of these strategies is beyond the scope of this project.

This report is based on several 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 overly burdened by existing regulations, and are not likely 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 forestland 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. The application of adaptive management principles (see Flexible and Dynamic Management Approaches, pp. 32-34) will help us learn from our experiences in implementing various management strategies.

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 which will simultaneously

generate revenue from activities that are harmful to biodiversity and that can contribute to more sustainable practices.

Policies at all levels of government can help or hinder biodiversity conservation efforts. Some policies may inadvertently discourage conservation and could be modified. For example, some landowners are reluctant to restore riparian lands by planting trees that may be harvested later because they do not want to be regulated by the Oregon Forest Practices Act which requires additional permits and limitations on their activities.

An incentive program should give people credit for improved stewardship even if “perfection” is not reached. Land management objectives will differ and it will take time to implement improved practices. 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 Oregon’s biodiversity.

Landowners and managers need to see the larger context to determine where they fit in and what they could do to conserve biodiversity. Being part of a regional watershed

plan or broader effort will produce greater benefits for all participants.

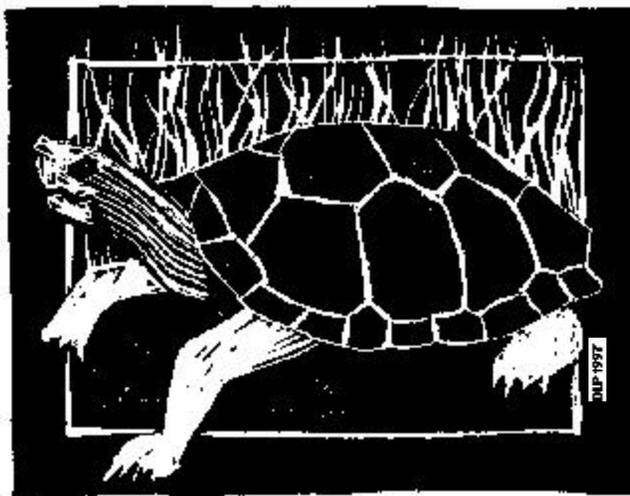
One size does not fit all. A good incentive program is flexible enough to accommodate different circumstances and new information and ideas.

Incentives should supplement—not replace—regulation. Regulation has been effective in controlling certain activities that damage the environment while creating a “level playing field.” Regulations serve to identify an expected level of stewardship, while incentives can be useful to promote additional care of certain public values on resource lands.

Specific goals are needed for incentive programs. In order to ensure that results are achieved on the ground, it is essential to establish specific management targets that can be measured over time. A good monitoring program is important.

CONSERVATION INCENTIVES

The notion of stewardship incentives suggests different things to different people. Some imagine market-based incentives in which consumers' purchasing decisions stimulate improved management. Others envision direct financial support for habitat restoration or land protection. Some focus on technical assistance or recognition as rewards for stewardship.



For the purpose of this report we have defined incentives broadly to include anything that may motivate people to adopt improved land management practices to conserve biodiversity. Based on research and personal interviews, we have also proposed some criteria for selecting incentive programs. Finally, we offer some promising incentive options that appear to have wide acceptance and good chances of success.

DIFFERENT TYPES OF INCENTIVE PROGRAMS

A number of different kinds of incentive programs are currently 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 below:

Direct financial assistance can be offered to landowners for many different things. 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, certain publics expect more direct benefits to accrue to taxpayers when improvements are made 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 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, 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. The lack of easy access to quality information has been a significant barrier to the development and implementation of conservation plans. The existence of 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 regulations that sometimes differ from one agency to the next. Some landowners feel that the existing mix of requirements does not provide a climate in which people are likely to make 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 to adopt good stewardship practices. Some 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 lands to do a better job, and to encourage corporate landholders to help them.

Market-based incentives are 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. In Oregon, the Northwest Food Alliance is discussing certification for sustainable agriculture, and the Pacific Rivers Council promotes a “salmon safe” label for foods grown in a manner compatible with the conservation of fish and fish habitat. Also in Oregon, the Rogue Institute’s SmartWood certification program has certified over 5,000 acres belonging to more than two dozen landowners, and three secondary manufacturers for processing products made with certified wood: Endura Hardwoods, Natural Home Store, and Dave Maize Acoustic Bass Guitars (Gretzinger pers. com. 1997). Golf courses throughout the United States are certified by Audubon International of New York for meeting certain environmental

management standards. However, the proliferation of multiple certification programs and the inability of consumers to determine what they really mean may inhibit their utility as an incentive option.

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

INHERENT WEAKNESSES

In Oregon, as elsewhere, a sometimes odd assortment of incentives and disincentives has arisen in response to specific circumstances. A lack of overall, coordinated planning is conspicuous. In this section, we look briefly at some of the reasons why incentives haven't always succeeded in Oregon, and how existing disincentives similarly limit success.

INCENTIVES

Many programs are already in place 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 in Oregon, and will continue to make an important contribution. Collectively, however, the existing incentive programs are insufficient to conserve Oregon's biodiversity. A few of the reasons follow:

Some incentive programs now in place 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.

People may not be aware of incentive programs, and consequently, fail to apply for them. "Marketing" 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 technical assistance needed for successful project design, implementation and monitoring. The Natural Resource Conservation Service, U.S. Fish and Wildlife Service and Oregon Department of Fish and Wildlife all 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. The net effects sometimes discourage people from applying because of the paperwork; because they channel funding into projects of marginal utility simply to fit the guidelines; and because they 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. Examples follow:

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 for its intended purpose (Rochelle pers. com. 1996, Starker pers. com. 1996). In extreme cases, landowners might consider removing the endangered habitat 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 pers. com. 1996).

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. pers. com. 1996).

Finally 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 pers. com. 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 may motivate people who are already inclined to manage for conservation to do a bit more, one shouldn't expect major new efforts on the promise of a brass plaque. Purchase of lands or easements for conservation or payments for environmental services are among the most direct (and the most costly) means of matching the reward to the effort. If the payment isn't high enough, landowners will simply 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. Programs can remove obstacles, streamline regulations, make information available and easy to understand, or provide stability or reduce uncertainty, thereby making land management less costly. 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.)

Are there unrecognized costs to the participants in the program? “Certification” is becoming increasingly popular as a way to provide financial incentive to producers and landowners to manage for conservation. It is hoped that if 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 to be. 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. Use of “green” packaging by advertisers to sell products that haven’t passed any standards aggravate the problem by making consumers suspicious (Montgomery pers. com. 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. Most members of the Oregon Biodiversity Project’s Implementation Committee agreed the conservation needs should be broadly defined to address improved stewardship across the landscape, and not limited to endangered species or forested landscapes.
- 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 don’t 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.

MOST PROMISING INCENTIVES

The following ideas come from the many reports, discussions and evaluations compiled or initiated by the Oregon Biodiversity Project. Although the selection of the best was subjective, an effort was made to select ideas that would meet the criteria described earlier, and would be acceptable enough to most constituent groups to make them politically viable.

STEWARDSHIP COUNCILS

Although many individual conservation efforts are underway, coordination and leadership are lacking in this instance. The Governor could appoint a stewardship council to address natural resource issues statewide, with an emphasis on facilitating cooperative, public/private partnerships for conservation that do not require new regulation.

The council could be composed of prominent citizens with interest and expertise in economics and conservation. It could

be an independent entity with a small administrative staff and no regulatory authority. Its purpose would be to facilitate the development of a vision for Oregon's natural resources over the long term. The council 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 a lower cost with reduced conflict. The council would need to address issues under state, federal and private jurisdiction. In addition, the Governor could direct the stewardship council to conduct a review and analysis of the most significant disincentives and to propose solutions.

Above all, its role would be one of providing leadership, inspiration and strategic vision to the people of Oregon, not just responding to brush fires. The council should remain in place as long as it fulfills its role.

Regional stewardship councils could also be established. The purpose would be to provide assistance and coordination to local planners, watershed councils, private landowners, resource agencies, as well as to serve as a liaison to the statewide stewardship council and help implement its recommendations. A small staff for each council could collect and distribute relevant information to local efforts, provide technical assistance or help people obtain it. Forums and workshops could be organized periodically to facilitate communication and education.

Although some concern has been 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. For example, decisions concerning water management, migrating wildlife, and transportation must take into consideration larger landscape areas. A review of existing entities (Governor's Watershed Enhancement Board and Soil and Water Conservation Districts) should be undertaken prior to the establishment of new councils to avoid redundancy and waste.

WATERSHED COUNCILS

Watershed councils have emerged as a new "institution" to facilitate community-based conservation. Oregon now has over 100 watershed councils at various stages of maturity. Some are staffed, others are not. They vary widely in composition, level of technical expertise and experience in collaborative decision-making. Most are established in response to a crisis, often related to endangered fish and/or water quality issues. None has regulatory authority. Lack of secure funding tends to inhibit 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 and effective, watershed councils provide powerful incentives to landowners by coordinating information on grant programs, sharing technical

information, and exerting subtle or not-so-subtle peer pressure. With encouragement and assistance, watershed councils can play a major role in biodiversity conservation efforts, assuming that is one of their goals.

STEWARDSHIP CERTIFICATION

Stewardship certification is a means of sanctioning, or certifying, the land management operations of various landowners according to established criteria. Some have proposed it as a way to provide marketplace advantages, recognition 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; it can be implemented without new legislation and without the infusion of major public funding; it is voluntary; and, it 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 wide-spread

skepticism of what may be perceived as yet another meaningless advertising ploy (Montgomery pers. com. 1997).

Although a number of certification efforts are already underway, an umbrella program with a broader focus than existing ones could address a larger group of participants, enhance the overall credibility of programs and bring order to an oftentimes 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 could also 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 thus, different certification standards. SmartWood and others are involved in public land certification on state and county land in Massachusetts, New York, and Wisconsin (Gretzinger pers. com. 1997).

Certification would be based on general stewardship principles, with flexibility for local conditions. Many overall stewardship guidelines have already 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 certified status to promote their products and services through special labeling and additional information to consumers.

Certified landowners could be eligible for other incentive programs. For example, 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. One controversial example of this approach is the use of Habitat Conservation Plans in exchange for incidental take permits under the federal Endangered Species Act. Waiving the 15-day waiting period required by the Oregon Forest Practices Act, or allowing “certified” companies to proceed

without written plans, would also be appealing (Messinger pers. com. 1997). Tax and subsidy benefits could also 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. The golf course certification program described on page 81 uses this approach, and the SmartWood program is structured to help managers improve over time.

Training for managers and certification of technicians could be offered by various public and private entities. A number of training programs are available: The Olympic Peninsula Foundation in Washington State, for example, focuses on professional foresters.

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 farm and forest lands. Tax bills of up to 55 percent of the value of the land can create insurmountable financial hardships for people inheriting property (which includes small businesses, as well as land). 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.

Oregon's riparian tax incentive law was recently reauthorized. 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.

Tax incentives for managing habitat. Oregon's 1997 Legislature recently expanded a pilot program from Marion and Polk Counties in the Willamette Valley to the rest of the state. Landowners in areas zoned for farm and mixed farm and forest uses can now receive property tax benefits for restoring and managing wildlife habitat according to plans approved by the Oregon Department of Fish and Wildlife. Reduced property taxes had previously been enjoyed only by

those actively farming or growing timber for commercial purposes. Prime farmland does not qualify unless it is covered by a federal conservation program. This program, when fully implemented, will provide a tremendous incentive to restore and manage wildlife habitat for Oregon landowners who do not depend on income from agriculture or forestry. Private organizations, working with the Oregon Department of Fish and Wildlife, can carefully target high-priority lands and work directly with landowners to develop and implement plans.

BETTER INFORMATION FOR CONSERVATION PLANNING

One of the most powerful incentives for improved land management and stewardship is better and more accessible information. A few specific suggestions follow:

Improved management of resource information and cooperative planning are often cited as critical to enhanced stewardship of natural resources. This includes 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). If this approach leads to widely accepted long-range plans, it may offer more 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 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. Tracking the ever-changing programs is difficult. 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.

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, discussed above, could help facilitate the transfer of this information to managers.

Make institutional adjustments necessary to facilitate better communication between scientists and policymakers. A number of barriers inhibit effective communication between scientists, policymakers, 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, policymakers and the public would be greatly facilitated.

It would also be helpful for scientists whose work is funded with public funds to 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** where 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).

Allocate a greater percentage of government research funding to projects supporting sustainable natural resource management. In recent years, less than one 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 work is needed to determine how to manage farms holistically and sustainably. More research on ecosystems is needed to help land managers implement ecosystem management (Svejcar pers. com. 1997). More research is needed to determine how to manage low-impact specialty products, like floral products, 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 landowners. Creatively structured and implemented, this approach 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 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, a fill and removal permit, water storage permit and county restoration permit may all be required before a five-acre restoration project can begin. Private landowners can be forced to spend \$3,000-\$5,000 before they break ground (Lane Council of Governments 1996). Although legitimate reasons can be found for many of these regulations, sometimes they inadvertently inhibit positive actions.

“Green planning” has been proposed in Oregon as an entirely new, performance-based approach to managing environmental issues. 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. The concept of “green planning” could be addressed by stewardship councils, described previously.

MITIGATION BANKING

This concept is defined in Oregon as “a program that compensates for expected wetland losses before they occur and provides a means to pool several individual mitigation projects into one or more carefully planned and monitored sites” (Oregon Division of State Lands 1997). It could be expanded to protect Oregon’s significant biological resources. A reevaluation of the existing system is needed to determine the feasibility of establishing a fund to finance priority projects (perhaps by region) instead of requiring on-site, in-kind mitigation for the destruction of wetlands. A percentage of system development fees could also be allocated to the fund. Although changes to Oregon’s mitigation banking rules have occurred, the existing system remains complicated and produces limited ecological benefits.

A similar idea has been proposed at the federal level by Zygmunt Plater, a Boston law professor. Plater suggested the creation of an Endangered Habitat Superfund to help fund land acquisition and other mitigation measures often required by the resource agencies as a condition of approval of Habitat Conservation Plans. Part of a developer's fee could be paid into the fund, along with contributions from the general treasury. The money could also be used to help pay for the implementation of plan amendments that may be required if additional species are listed after the plan is approved, or to monitor the effectiveness of the plans over time (Margolis 1997).

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 ten percent of all public land use fees. Funds could be used to purchase land, establish easements, implement wildlife-friendly management practices, and 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 pers. com. 1997).

Oregon could create a substantial **investment fund** to finance conservation projects. Competitive grants could be submitted to a board that would allocate funding to projects meeting established criteria. Although the Governor's Watershed Enhancement Board addresses this need to a certain extent, it could be expanded.

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 pers. com. 1997).

Conservation easements are an important non-regulatory tool. They can be sold at full market value, donated or sold at reduced prices. The method chosen depends 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 pers. com. 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, etc. 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 areas of interest for the purpose of conserving 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. If it were legal to cultivate industrial hemp, it could be grown to produce fiber which could be used as substitute for crops that cause greater environmental impacts (Bilodeaux 1997).

Alternative forest products also offer opportunities consistent with sustainable forestry. In the Pacific Northwest, special forest products (for medicinal, floral, food uses) account for over \$200 million in revenue annually—a substantial amount relative to \$2.63 billion in stumpage receipts in 1989 (Molina et al. 1997).

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

OREGON'S MAJOR LAND USES

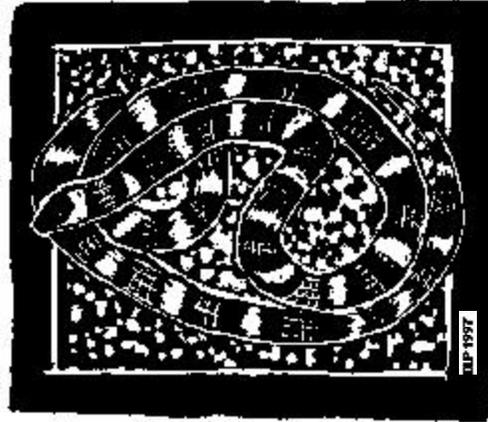
BIOLOGICAL DIVERSITY

Any meaningful discussion of Oregon's land uses first requires an understanding of biological diversity, or biodiversity. Definitions of biodiversity can vary. For our purposes, we define it as the variety of 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 physiography, climate, soil, and species composition. (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 disturbances. Ecological succession occurs when the composition, structure and processes are changed. Humans can affect succession and other ecosystem processes either deliberately or inadvertently through various activities on the landscape (Wisconsin DNR 1995).

For this report, our focus is on maintaining native plants and animals and the communities and ecosystems in which they occur. This approach was chosen because traditional conservation strategies have favored pieces of the puzzle (typically, individual species) rather than the whole. As a result, some important elements of biodiversity—certain community types and ecosystems—have been overlooked. A broader assessment may help address these "gaps" before they become crises.

Addressing the gaps will require a range of strategies including the establishment of reserves, which may be 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 integrated as important secondary purposes.

IMPORTANCE OF BIODIVERSITY

Biodiversity is important because it has intrinsic value. 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 arguments are often underemphasized. We place them first in this report, and offer in addition the following practical reasons:

Biodiversity supports the integrity of 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 to build homes, as well as 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 ecosystem degradation that leads to listings (Brussard 1994).

SCALE AND CONTEXT

Effectively conserving biodiversity requires an approach that considers both scale and context. The concept of 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.

Sometimes, managers seeking to achieve biodiversity goals focus on the maintenance of species diversity on a refuge, park, or other relatively small site. Unfortunately, maximizing diversity on one site may reduce diversity on a regional scale

if the creation of edges and openings attracts many common species while diminishing habitat for species needing larger habitat blocks.

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 streams enter urban and agricultural areas in the lowlands, they may be contaminated again if systems are not in place to control sedimentation and chemical pollutants.

Unfortunately, jurisdictional boundaries rarely match up 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 some hydrologic processes, but do not define appropriate units for fire, wildlife, or 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 substantial 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.

ESTABLISHING MANAGEMENT GOALS

Since the concept of biodiversity is so broad and interpreted differently by many interests, it is essential to establish specific management goals, objectives, and targets to guide 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 pers. com. 1997).

AN INTEGRATED APPROACH

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). Table 1 summarizes a new model that encourages more cooperative behavior, better communication, innovation and accountability.

CONSERVING BIODIVERSITY ON THE MANAGED LANDSCAPE

In some circles, conserving biodiversity is synonymous with establishing reserves where nature operates relatively freely from 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 and to support all elements of biodiversity.

Many existing 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, in private ownership. Many are used for agriculture.

TABLE 1

Behavioral bias	Policy problems created	Solutions
Short-term rationality out-competes long-term rationality	Poor long-term direction	Learn about the future. Commit to the future through directives, information and “fixers” (involvement of outside groups who 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	Develop processes that promote sharing and develop trust and relationships. Protect the potentially exploited. Focus on most important goals. Be firm on ends; flexible on means to reach 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 (i.e., debate and discussion between conflicting sources of expertise).

Adapted from: Yaffee, Steven. 1997. Why environmental nightmares recur. *Conservation Biology*. Vol. II, no 2.

Reserves imply a “separateness” that makes political support difficult to generate and sustain. Support for conservation is more likely when people experience a problem and become part of the solution.

Private lands already support significant elements of biodiversity. Given the proper incentives, private lands could play a much greater role.

FLEXIBLE AND DYNAMIC MANAGEMENT APPROACHES

Unfortunately, our existing system of land use planning, state and federal laws and regulations, and tax policy were not developed with biodiversity conservation goals in mind. With the possible exception of 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:

Maintain the viability of native plants and animals; encourage the restoration of viable plants and animals; complement regional and global biodiversity efforts; and educate

employees, community leaders and the public about biodiversity conservation (Cubbage 1997).

Table 2 (next page) compares some contemporary, integrated management approaches 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.

Some specific, integrated, dynamic management approaches that have found widespread support in recent years include 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 at the core, 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).

TABLE 2

	Traditional approaches	Contemporary 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. In Pickett et al. (eds.) *The Ecological Basis of Conservation*. Chapman & Hall. New York.

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 riverine 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.

BIODIVERSITY AND OREGON'S MANAGED LANDSCAPE

Although Oregon has many refuges, parks, wilderness areas and other lands managed to conserve their natural values, the majority of the landscape is used for other purposes. The dominant uses are agriculture and forestry. Some areas are subject to intense development pressure to accommodate a rapidly expanding population.

The following is a discussion of Oregon's major land uses relative to biodiversity conservation. Since agriculture and forestry lands are the most extensive and have the greatest potential to support biodiversity goals, they are given priority attention in the report. Most lands, including parks and refuges, support some elements of biodiversity, but may adversely impact other elements. Consequently, the positive and negative impacts are discussed for each land use, 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 statewide. In other words, if incentives are offered, what outcomes are they expected to achieve? In general, we hope incentives will be used to encourage improved stewardship of the entire Oregon landscape.

However, since there will be limited resources to finance incentive programs, we suggest that they focus on areas deter-

mined to be high priority for ecological reasons, and that they be used to make biodiversity-friendly management practices more economical for landowners who take significant risks and make special sacrifices to protect natural values on private lands. 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. Therefore, reading the introductory portion of each major section (e.g., Agricultural Lands) is suggested before turning to sub-sections addressing a particular activity (such as Christmas tree farms).

AGRICULTURAL LANDS

Agriculture is extremely important to Oregon's economy, contributing approximately \$10 billion annually, or up to 17 percent of the state's gross product. Oregon's agricultural land base is over 16 million acres of which 1.9 million acres are prime farmland. Seventy-one percent of prime farmland is in the Willamette Valley (Andrews 1997).

Farming in the Willamette Valley is the most profitable in the state, with gross income per acre eight times the state average (Andrews 1997). However, of the 37,000 farms in Oregon, about one-third market less than \$2,500 per year (Oregon Department of Agriculture n.d.), and some are not profitable at all (Liberty 1997).

Agricultural lands provide important wildlife habitat, open space and aesthetic qualities. Farmland is under increasing development pressure. Between 1987 and 1992, 18,000 acres were converted to other uses (Oregon Department of Agriculture n.d). 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 for the future, according to retired Oregonian editor Jerry Tippens, is for agriculture to accommodate environmental goals and for conservationists to accommodate agriculture (Tippens 1997). However, there are sharply contrasting views concerning sustainability and how it can be

accomplished. Some groups advocate a softer touch on the land through reduced chemical and fertilizer use, alternative cropping, etc. (Bird et al. 1995). 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 section to follow addresses a broad range of agricultural activities as they contribute to and impact Oregon's 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. These 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.

CONTRIBUTIONS OF AGRICULTURAL LANDS TO BIODIVERSITY

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

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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 Oregon, large ungulates, like 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; and, raptors are often seen hunting rodents on farm fields.

Beyond the obvious, however, agricultural lands are important to biodiversity for two additional reasons. The first is that the most productive and biologically diverse lands in Oregon were settled and converted to agricultural uses long before public lands were set aside for conservation. Most of these lands are in private ownership in valleys, and possess abundant water, rich soils and gentle terrain important to agriculture and 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 urban and industrial areas where natural habitat has been irrevocably altered and developed.

Our premise is not that lands now managed to produce food and fiber should be restored to natural conditions and managed exclusively for biodiversity values. Rather, our point is that 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 Oregon’s biodiversity, and to identify motivating factors and potential incentives for farmers to meet biodiversity goals.

BIODIVERSITY ISSUES AND IMPACTS

Many agricultural activities can cause adverse impacts to 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).

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Reduction in water quality and quantity thwarts 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 has serious consequences for all wildlife, soils and water quality (Bird et al. 1995).

Removal of riparian vegetation by livestock or through cultivation, can reduce or degrade riparian habitat for aquatic and terrestrial wildlife (National Academy of Sciences 1982).

Deterioration of soils from compaction and erosion can adversely affect the long-term productivity of the land and hydrology of the watershed (National Academy of Sciences 1982).

Spread of invasive exotic plants and insects threaten both agricultural crops and natural communities, and require costly control efforts (BLM 1996c).

Use of indiscriminate animal damage control methods can inadvertently kill wildlife beyond the targeted species, 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:

Location of farmland relative to other land uses is a critical decision made at the landscape scale. Oregon's 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. Several habitats not well-represented within Oregon's network of conservation lands occur in agricultural areas (Oregon Biodiversity Project 1998).

Conserve patches and strips of native habitat. Native shelterbelts and hedgerows effectively provide food and shelter to wildlife and require little area and maintenance. The protection of special areas (like bat caves, rock piles and woodlands within farmed areas) can provide wildlife habitat. Brush piles provide cover for many species. Unfarmed areas can also provide habitat (Clark and Rollins 1996).

Ensure fish passage in agricultural waterways through proper construction and maintenance of culverts, dams, bridges and other in-stream structures. Prevent fish stranding and other forms of mortality with screening water diversions.

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Maintain and protect riparian and wetland areas.

Protective strips of native vegetation to buffer riparian areas are highly effective at reducing erosion and blocking chemical flows. Establishing vegetation next to ponds, sloughs and ditches also provides habitat. Where erosive streambank damage is already advanced, restoration techniques to stabilize streambanks 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 1996).

Allow natural regeneration from small natural disturbances, such as leaving fallen trees in streams or ponds to enhance natural vegetative diversity.

Stop the spread of invasive exotic plants and pests.

Promptly removing invasive weeds before they become established, purchasing feed and seed certified for vegetal purity, washing vehicles operated in weed infested areas, and educating to identify and control invasive species are some important steps in controlling the spread of exotics (BLM 1996c).

Use integrated pest management to control insect and other animal damage. Integrated pest management refers to the use of a wide variety of techniques—biological, cultural, mechanical and chemical—in approaching a pest

problem (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).

Use alternative cropping. 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).

Withdraw water conservatively. Proper scheduling (avoiding times of high wind and temperatures), adequate pressure, even application, close monitoring and ensuring leak-free systems can substantially reduce water withdrawals, thereby 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.

SUSTAINABLE AGRICULTURE

Sustainable agriculture is a long-term goal 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 information intensive management. Many mainstream commercial farmers are adopting cost-effective sustainable practices.

In the past 10 years, public-sector support for sustainable agriculture research and education has been greatly expanded through programs such as the USDA Sustainable Agriculture Research and Education grants. These programs, along with support from private foundations, non-profit organizations, and the innovations of thousands of farmers, have led to substantial changes on farms 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 farmers to

use sustainable agriculture approaches. 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 quantify the risk to farmers making changes in their production practices.

General recommendations for sustainable agriculture include:

Use less land for row crops-more land in hay, small grains, forage and pasture, woodlands, wetlands, and 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 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: David Granatstein, Washington State University Cooperative Extension, 1997 and Bird et al. 1995. Planting for the Future: Developing an Agriculture that Sustains Lands and Community.

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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 over the last forty years are saving over ten million acres of wildlife habitat around the world. The Soil and Water Conservation Society of the U.S. 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 (Hudson Institute 1997).

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 through 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 (Wistisen 1997).

Sources: Hudson Institute and Martin Wistisen, AgriNorthwest, 1997.

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

Reduce soil loss and compaction. 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).

Reduce chemical contaminants. Biological controls reduce the need for herbicide and pesticide inputs by maintaining 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).

Recycle materials. Recycled materials (food wastes, containers, construction materials, etc.) do not end up in a landfill and the demand on virgin resources is reduced.

Save energy. Efficient energy use, particularly of fossil fuels in agricultural operations, contributes to broad biodiversity

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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 pp. 38-39), holistic management, coordinated resource management (see page 53), and permaculture—an integrated system encompassing not only agriculture, horticulture, architecture and ecology, but 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. Under Oregon law (Senate Bill 1010), watershed plans and individual farm plans are being written to address water quality issues. Some financial assistance is available from soil and water conservation districts to implement the plans (Colby 1997).

EXISTING AND PROMISING INCENTIVES

A variety of incentives have been available to farmers for many years. Their success in encouraging the adoption of new techniques has been mixed. Certainly one potential problem with any incentive program is lack of participation. 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 assistance along with the 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 be funded at a level high enough to significantly offset the 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 pers. com. 1997). An "enhancement option" allows the state to supplement federal funds to create an economically viable payment of \$80-\$100 per acre. The result could be restoration of 4,000 acres of riparian habitat in Oregon (Gibbs pers. com. 1997). However, the actual biodiversity benefits associated with implementing the new rules

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remain unknown, and could even cause some adverse impacts to the land by removing previously conserved areas from the program (Granatstein pers. com. 1997). Apparently, in Oregon, lands to be removed from the CRP are not as ecologically significant as the riparian areas to be included, so the changes to the program are likely to be beneficial to biodiversity overall (Streif pers. com. 1997). In any case, NRCS programs, properly targeted and administered, are critical to Oregon's biodiversity.

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 non-federal landowners. Projects are designed to help protect, restore and enhance wetland, riparian systems and associated uplands. The Service distributes the funds broadly to encourage partnerships and cost-sharing (Smith, M. pers. com. 1997).

Direct financial assistance to offset costs associated with ecological restoration efforts and loss of income due to reduced production in areas managed for biodiversity values may be the most appealing to some landowners (Streif pers. com. 1996). Cost sharing for restoration is already provided through a number of agency and private efforts. A deliberate,

strategic and streamlined process with additional funding could improve biodiversity values in priority areas by increasing participation.

Economic adjustments. David Granatstein, a Washington State Agricultural Extension Agent, has identified a range of taxing strategies and other economic incentives for growers to adopt improved management practices. Surcharges can be used in association with environmental labels ("ecolabels") to raise funds for developing and implementing improved practices in a given sector. For example a dairy initiative in Pennsylvania 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 (Granatstein pers. com. 1997).

The Wisconsin Conservation Credit initiative provides property tax credits to growers following an approved conservation plan.

In Washington, crop insurance against loss is provided to farmers using pheromones instead of pesticides to control insect damage on an experimental basis, for a limited time.

Lower interest rates on farm loans could be provided to responsible stewards (Granatstein pers. com. 1997).

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Additional technical assistance and information about incentive programs. To the extent that assistance can be provided by non-regulatory agencies, or individuals within agencies who do not have enforcement responsibilities, landowner acceptance may be improved. 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 pers. com. 1996).

Market incentives can be used to encourage the adoption of sustainable agricultural practices. For example, special labeling can alert concerned consumers to products produced using sustainable methods. Assistance with marketing specialty products would encourage more farmers to produce them (Chambers pers. com. 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 awards are unlikely to be sufficient to encourage the adoption of new, costly management programs (Montgomery pers. com. 1997)

Controlled access. 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. Some landowners may generate revenue through fee access to habitat areas for outdoor recreation (Smith, S. pers. com. 1996).

Integrated farming systems. The USDA 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. Regulations are sometimes narrowly

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focused, perceived as too prescriptive, and can cause a great deal of unnecessary delay and paperwork. To implement this idea 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.

Since agricultural activities are not heavily regulated at present, the primary motivating factor for the industry may be to adopt improved management practices to avoid additional regulation or to develop a two track system to relieve the best managers of prescriptive requirements as long as goals are met.

Removal of disincentives. Some farmers have been reluctant to establish riparian protection zones because of a concern that harvesting trees in the zone would require compliance with Oregon’s Forest Practices Act. Oregon legislation, approved in 1995, addressed the issue, but uncertainty and apprehension remain about the need for forestry permits. Harvesting riparian lands in Oregon is not subject to regulation until after the first rotation, but prior contact with the Department of Forestry is required. State laws and regulations should be reviewed and modified as necessary to make riparian forest restoration projects in agricultural areas as simple as possible (Buchanan pers. com. 1996).

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 pers. com. 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 pers. com. 1996).

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

Oregon’s new law could be fully implemented providing tax benefits to landowners who conserve habitat. SB 791 authorizes reduced property tax rates for landowners in farm and mixed 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. *The Oregonian* reported that “hobby farmers” are less likely than

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

MANAGEMENT PRACTICES AND INCENTIVES FOR SPECIFIC AGRICULTURAL LAND USES

Particular management practices and incentives can be unique to specific crops, land uses or regions of the state. Given the ecological and economic complexity of Oregon's agriculture, offering universal management guidelines or specifying the most important incentive for each crop is not possible or reasonable. The ideas that follow provide some examples of changes in management and potential incentives that could be adopted. To avoid redundancy, previously listed management practices and incentives are not repeated.

Row Crop Farms, Nurseries, Orchards, Vineyards, Christmas Tree Farms

Although variations exist among these land uses, they are grouped here because of their similarities in management strategies relevant to biodiversity. The purpose is not to offer detailed management prescriptions for every land use, but to highlight some of the strategies that could improve stewardship. Each operation needs a long-range stewardship plan,

developed in cooperation with adjacent landowners, that emphasizes continual monitoring and improvement.

• *Row Crop Farms*

Oregon produces a wide variety of row crops. Some are extremely profitable. For example, horticultural operations in the Willamette Valley can support a family with less than 10 acres, yielding \$5,000-\$10,000 per acre. These specialty crops include baby carrots, vegetable seeds, and other products (Bird et al. 1995). Row crop farm management techniques that benefit biodiversity include:

Barrier strips (e.g., planting oats between onion rows) to reduce wind erosion where it is a serious problem (Granatstein pers. com. 1996).

Tailwater ponds at the drainage end of rows to reduce waterway disturbance and improve water and nutrient distribution among row crops (California Biodiversity Council 1995b).

Native hedgerows and shelterbelts to provide terrestrial habitat and control of erosion and water loss.

Crop rotation to maintain diverse microbial and arthropod populations, to lower crop vulnerability to pests and to reduce pesticide applications (Journal of Agriculture and Environmental Affairs 1993).

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Native cover crops to retain moisture, control erosion and lower fertilizer use (California Biodiversity Council 1995b).

Conservation tillage to reduce soil loss and erosion (Pacific Northwest Extension 1986).

Scheduled irrigation water withdrawals to avoid water depletion prompted by high temperatures and wind, to ensure uniform application with adequate pressure, and to encourage the selection of shorter-season crops (Trimmer 1994).

Contour plowing to prevent water and nutrients from running straight down hill (Granatstein pers. com. 1996).

Maintenance of native vegetation along irrigation canals and field perimeters—trees, shrubs and grasses (Beck pers. com. 1997).

Straw or biodegradable synthetics (e.g., polyacrylamide) to strengthen soil and reduce erosion (Granatstein pers. com. 1996).

- **Nurseries**

Nursery products are now Oregon's leading agricultural commodity. Oregon has more than 1,200 growers with approximately 30,000 acres in production. Most are in the Willamette Valley (ODA 1996b).

Nursery stock imports and propagation pose some significant threats to native biodiversity. They can, for example, result in the introduction of exotic pests, plant diseases, noxious weeds and the associated deterioration of native species (ODA 1996b). In some cases, retail nurseries continue to sell invasive exotic plants that may become established in natural areas, literally taking them over. Invasive exotics like English ivy and Scotch broom are still commonly sold for landscaping purposes. Purple loosestrife, a plant seriously threatening Oregon's wetlands, was originally introduced in wildflower seed mixtures (see discussion on Exotic Organisms, beginning on page 97).

At the same time, nursery products can be grown sustainably, often in conjunction with other activities. For example, restoring cultivated agricultural areas to riparian forest can enable the commercial harvest of special products for floral and nursery sales, like sword fern, salal, trillium and other native plants. Native plants are in demand for the increasingly popular "naturescaping" of suburban gardens where people are seeking lower maintenance and backyard wildlife (see box on page 76). Examples of potential incentives for the nursery industry include the following:

Stewardship certification programs for retail nurseries that make special efforts to conserve biodiversity would have important educational benefits and potentially increase sales for participating nurseries. For example, certificates could be

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offered to nurseries that train employees in identifying pests and invasive plants; refrain from selling invasive exotics; promote and sell native plants; and, provide information to consumers about landscaping to enhance biodiversity.

Tax incentives to producers of nursery stock with stewardship plans, and additional incentives to producers who specialize in native plants.

- **Orchards**

Oregon is well-known for the production of fruit, especially in the Hood River, Willamette and Rogue valleys. Approximately 48,000 acres are currently in production. Many of Oregon's orchards are being converted to residential and commercial uses. Orchards are especially attractive to insects and migratory birds, which can occasionally become a nuisance as the fruit ripens in the summer.

Several common practices in orchard management can adversely affect biodiversity. The removal of floor vegetation to maximize tree growth and minimize weeds can cause soil erosion and increased water runoff that damages riparian systems. In some orchards, heavy pesticide use can kill non-target species, lower species diversity and affect the reproductive success of avian species (Fluetsch 1994). Excessive nitrogen leaching from heavy fertilization may damage aquatic species (Ingels 1993).

Orchard management techniques that benefit biodiversity include:

Alternative strip management to maintain native floor vegetation and native cover cropping (Buggs 1987).

Pesticide reduction or elimination to protect beneficial insects and reduce impacts to other wildlife (Buggs 1987). Use alternative methods when pest control is needed.

Conservation tillage, crop residue use and critical area planting to reduce soil erosion and compaction, and increase soil aeration and water retainment (Bell 1993).

Winter annual cover crops (non-legumes) to reduce nitrogen leaching (Ingels 1993).

- **Vineyards**

Vineyards are a major land use in the Willamette Valley and Oregon wines are a growing international commodity. In 1996, Oregon had about 400 vineyards, covering about 7,500 acres (ODA 1997). Oregon's vineyards provide important wildlife habitat and offer a number of opportunities to demonstrate the application of sustainability standards. Improper management of vineyards can adversely affect biodiversity through excessive water and pesticide use, overzealous insect and bird control efforts, and soil erosion and compaction.

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Many vineyard owners have a special interest in improved management practices and have adopted new, environmentally sensitive strategies such as organic farming. Members of Oregon's wine industry have initiated a certification process to develop a label to distinguish wine made from sustainably managed vineyards. Using European standards as a starting point, a set of management guidelines has been developed, complete with a scoring system for each management practice (Miller pers. com. 1997, El Titi 1993). Vineyard management techniques that benefit biodiversity include:

Alternate cultivation and mowing cycles, and allow time between mowing and disking to ensure continual habitat and maximize biological control of pests (Ingels 1995).

Use netting to protect grapes from bird damage (Miller pers. com. 1996).

Plant native shrubs or native cover crops between rows. The shrubs can then be sold commercially as nursery stock (Miller pers. com. 1996).

Reduce fertilizer applications by planting legumes among part of the cover crop (Ingels 1995).

Maintain natural edges and adequate water buffers to provide habitat and control erosion (California Council on Biodiversity 1995b)

• *Christmas Tree Farms*

Oregon leads the nation in the commercial production of Christmas trees. Approximately 3,400 acres of natural stands and 57,000 planted acres are devoted to Christmas tree production, with most of that occurring in the Willamette Valley. Trees are generally harvested between their seventh and ninth years. The dominant species produced include Douglas-fir, noble fir and grand fir, all native to the Pacific Northwest (Ostlund pers. com. 1997).

Christmas tree farms offer benefits and threats to biodiversity that are similar to orchards, vineyards and row crops. However, the soil is not disturbed as frequently as it is with those three land uses, and the native trees provide better habitat for wildlife than some other agricultural commodities. In general, Christmas tree producers are not heavy users of fertilizers and pesticides. Many tree farms are managed by families whose primary income is not derived from farming. A desire to keep the land in agricultural production to keep property taxes low is a strong motivation to grow Christmas trees.

As with any farm, a long-term stewardship plan, developed cooperatively with neighbors and with the entire watershed in mind, is an important first step in conserving biodiversity.

Stewardship certification may be appealing to some growers as an incentive to adopt improved management practices. The

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special status can be used as a marketing strategy, and may appeal to consumers with an interest in conservation and a desire to patronize the best land managers.

Encourage Christmas tree growers to incorporate other native species with habitat and commercial values.

GRAIN CROPS

Wheat is grown extensively in eastern Oregon and now occupies approximately 127,000 acres statewide (ODA n.d.). Much of the Columbia Plateau has been converted to wheat and other grain production.

The primary threats to biodiversity associated with grain production include the loss of native shrub and grassland habitat; withdrawal of water for irrigation; and conventional tillage, which reduces the depth and quality of topsoil and causes runoff from winter wheat seeding (Pacific Northwest Extension 1986). A conservation strategy for Oregon grain producers might include several components:

Alternative crops, which more closely resemble native vegetation, use less water and provide some wildlife habitat. The establishment of demonstration projects in the Columbia Basin could promote this method.

Encourage grass-shrub waterways within fields, and

maintain natural vegetation along road right-of-ways and property boundaries.

Measures to control soil erosion and enrich the soil. Apply biosolids to fields (Granatstein pers. com. 1996) and encourage the adoption of no-till, or minimum-till, techniques (Pacific Northwest Extension 1986).

Modify harvest strategies to meet specific wildlife needs. Leave grain or stubble on fields after harvest to provide food for wildlife; leave a small portion of crops unharvested, or plant wildlife food plots; leave food stubble for waterfowl and shorebirds; delay grain harvests; modify mowing equipment and reduce mowing speed where necessary to avoid killing nesting birds (Clark 1996).

• **Grass Seed Farms**

Grass seed production is a major activity in the Willamette Valley and several other areas, involving approximately 450,000 acres statewide. Much of the original Willamette River floodplain and adjacent uplands have been converted to grass seed production. Some of Oregon's most endangered habitat types, including white oak woodlands, Willamette Valley prairie, riparian and bottomland hardwoods are all but gone, along with associated wildlife and plant species that once inhabited these areas.

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In the past, farmers commonly burned grass seed stubble in the fall following harvest to kill pests remaining in the soils. Field burning was curtailed in response to concerns about air quality and highway visibility. Operations now rely more on fungicide and pesticide use. Oregon State University has conducted some experiments with composting grass seed straw to protect crops (Edgar 1996). Farmers have adapted machines to mince the straw. New markets have been found for the minced straw, and new rotation crops have been identified. Farmers now plant meadowfoam, used in combination with herbicides to control weeds and unwanted grasses (Meehan 1997).

Soil erosion is a problem on farms where soil is left exposed to winter rains and floods. Cultivation to the edge of riverbanks is a common practice, heavily fragmenting riparian habitat. A stewardship strategy for grass seed operations might include:

Purchase or leasing of wetland, riparian and floodplain habitat from willing grass seed producers based on an evaluation of the overall distribution of grass seed operations throughout the Willamette Valley. Consider access for outdoor recreation, the feasibility of establishing contiguous strips or large blocks of natural and restored habitats, and ancillary benefits such as improved water quality and flood control (Gregory pers. com. 1997).

Maintain “ash swales” and native vegetation along drainage ways (Beck pers. com. 1997).

Demonstration restoration projects on public lands, especially at state parks along the Willamette Greenway, to inform grass seed producers and the public about important management strategies (Gregory 1997).

Cooperative agreements with willing grass seed producers to participate in riparian and floodplain restoration projects (Smith, S. pers. com. 1996).

Increased staffing and funding of incentive programs to encourage grass seed producers to participate in riparian and floodplain restoration projects (Smith, S. pers. com. 1996).

A pilot stewardship certification program for grass seed producers, with special recognition for participants.

Alternative crops—e.g., rice, meadowfoam, hybrid poplars, gourmet mushrooms—in riparian and floodplain areas. Increase production of native and “native-compatible” grasses (e.g., fescue) having lower water requirements (Caruana pers. com. 1996, Miller pers. com. 1996).

Financial incentives to remove or truncate drainage tiles, and to establish biofiltration swales to control runoff and provide wildlife benefits (Miller pers. com. 1996).

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DAIRIES, PASTURES, FEEDLOTS

Oregon's dairy operations occur primarily along the coast and in the western river valleys. Usually located near creeks, rivers and tidelands, dairies and associated pastures occupy some of the most important habitats for fish, waterfowl and other species. Dikes and tidegates on coastal pastures can reduce in-stream flows, acidify water, reduce intertidal wetland habitat and alter the composition of its vegetation, and cause marshland subsidence (Fell et al. 1992, Lundin 1996, Rumrill et al. 1995). The watering of livestock reduces streamside vegetation and increases erosion (Tillamook Bay NEP July 1996); fecal contamination can affect marine populations (ODEQ 1996b); and, exotic and noxious weeds can be introduced in contaminated feed (Lundin 1996 and Asher pers. com. 1996). A stewardship strategy for dairies, pastures and feedlots might include:

Make habitat investments (public land acquisitions, easements, etc.) in marginal agricultural lands where the potential to breach or modify dikes and tidegates can restore water flow, tidal flushing and estuarine health (Fell et al. 1992).

Avoid overgrazing pastures. The maximum number of animals should not exceed the capacity of pastures to regrow during the dry season (Wolf 1995).

Use electronic ear tags or single-strand electric fences to lightly shock cattle when they stray toward sensitive areas (Liverman pers. com. 1996).

Mimic natural grazing patterns that might have occurred with native ungulates, and preserve natural disturbance regimes (Cooperrider pers. com. 1996).

Avoid irrigation runoff by adjusting the timing and amount of water (Wolf 1995).

Rotate pastures to avoid overuse (Wolf 1995).

Build holding tanks and lagoons to store manure in winter and to keep it out of streams. Then work it into the soil in summer to fertilize crops (Calvert and Duncan 1994). Manage manure to avoid leaching into surface waters (Wolf 1995).

Fence riparian areas and provide off-channel watering of livestock (Rumrill et al. 1995). Maintain a vegetated buffer adjacent to surface waters (Wolf 1995).

Improve compliance with Confined Animal Feeding Operation guidelines, and continue to research nutrient and manure management techniques (ODEQ 1994).

Combine agriforestry with livestock production to protect riparian areas and make use of native plants (Logan 1993).

Use native seed for pastures and seed certified for vegetal purity where possible to prevent the spread of invasive weeds (Lundin 1996).

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Include legumes in pasture seeding to reduce fertilizer applications (Lundin 1996).

Reduce mowing speed in hay pastures where necessary to avoid killing nesting birds (Beck pers. com. 1997).

OPEN-RANGE GRAZING OPERATIONS

In Oregon, open range grazing is the dominant land use outside populated areas east of the Cascades. 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.

Improperly managed livestock grazing and fire suppression have contributed to the expansion of western juniper and invasive exotics like cheatgrass and medusa head into sagebrush grasslands (West 1993); and degradation of riparian habitats from erosion and ecosystem changes: These alterations have had a profound impact on rangeland ecosystems (OSU Extension Service 1993).

Roads and fencing can impede the movement of native wildlife, especially ungulates, 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 native species richness and diversity, increase vulnerability to exotic species invasions and degrade the soil. Predator control decreases native predator populations and disrupts biotic communities (Cooperrider pers. com. 1996). Fire suppression increases dominance of woody species and reduces herbaceous species and patch density (Svejcar 1996).

Protecting biodiversity in eastern Oregon does not mean returning to historical conditions (Tausch et al. 1993). Achieving “natural conditions” on many Oregon rangelands is problematic, given widespread ecological disturbances caused by nature and humans (Sprugel 1991). Realistic biodiversity goals should focus on maintaining ecological function 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).

• Rangeland Management Recommendations

Avoid continuous grazing at one site (Cooperrider pers. com. 1996).

Strictly control riparian grazing, using corridor fencing, separate pastures, regular herding, and supplemental water, salt and feed (Chaney et al. 1993).

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

Substitute traditional predator control methods with guard dogs, herding and selective control aimed at offending animals (Cooperrider pers. com. 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 like 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 conditions permit (Cooperrider pers. com. 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 pers. com. 1996).

Use prescribed burning to restore natural fire cycles (Cooperrider pers. com. 1996, Svejcar pers. com. 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 pers. com. 1997).

• *Rangeland Conservation Incentive Options*

Conversations with people interested in incentives for improved rangeland management covered 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, helping to improve opportunities to achieve biodiversity goals (West 1993).

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Coordinated Resource Management (CRM). 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 who may be excluded from the process (Myron pers. com. 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 deprecations. A major land exchange between BLM and private landowners was accomplished as part of the process. The Bridge Creek CRMP group has been formally recognized as a watershed council to obtain project funding from the state and other sources (Gibbs pers. com. 1997).

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

- 1) management by consensus;
- 2) commitment by all participants;
- 3) broad involvement by all interested parties, and
- 4) 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 streambanks. 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 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).

Holistic management 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 pers. com. 1997).

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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 pers. com. 1997, Holzman pers. com. 1997).

Additional research on the function of native and exotic rangeland species is needed to determine which are the most critical to maintaining soils and ecosystem processes, and to help guide management strategies (West 1993).

Flexible incentives are needed to facilitate the resting of overused areas. For example, agencies could provide alternate grazing land or supplemental feed for cattle to reduce pressure on sensitive areas (Holzman pers. com. 1997).

“Green marketing” for meat appeals to consumers interested in healthy products and good land stewardship, while improving public relations for ranchers. For example, Oregon Country Beef comes from 14 ranches across eastern Oregon committed to 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 area protection on private lands) would receive special grazing access to public lands (Otley pers. com. 1996).

Public land grazing fees 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 pers. com. 1997).

Allow private parties or use public funds to purchase grazing leases to retire associated Animal Unit Months (Myron pers. com. 1997).

Review the Federal Clean Water Act to identify and remove obstacles it presents for improved range management. For example, when Section 401 permits are under appeal, courts will not allow changes in management that are necessary to correct problems. Also, water-quality limited streams, listed under 303(d), could be reclassified when placed under a management system (Elmore pers. com. 1997).

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Establish an award and special recognition program for agencies and ranchers whose efforts achieve biodiversity goals.

Continue searching for new uses and improved harvest techniques for western juniper to provide economic incentives for its selective removal where it harms rangeland ecosystems. Juniper is now used for specialty furniture, desk sets, golf putter heads and aromatic oils (Hollon 1997).

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To many, Oregon is synonymous with forests that blanket much of the landscape. Forest products have dominated Oregon's economy for many years and remain important, especially to rural communities with a long history of reliance on timber for employment. Forests are also important to the tourism and recreation industries, and are part of the state's appeal to new businesses and residents. Oregon's image is one of lush, green rainforests with towering fir trees, like the ones typically found on the west side of the Cascade Mountains. On the east side, drier conditions have produced forests of a different character. Majestic ponderosa pines historically created a more open forested setting, maintained by periodic fires.

Forests cover about 27 million acres in Oregon, almost half the total land area. Approximately half of the state's forests are owned and managed by the U.S. Forest Service. The Bureau of Land Management owns forest lands in a checkerboard pattern throughout much of western Oregon. Altogether, about 16 million acres are federally owned; about one million acres, primarily in the Coast Range, are state-owned; and, the remaining forestland is in private, tribal or local government ownership. Six million acres of forest lands are managed by fewer than one hundred owners. Another 4.5 million acres are managed by 42,000 small woodlot owners, with parcels varying in size from one to 5,000 acres (McLennan pers. com. 1996).

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For the past few decades, heated debates over timber management practices on both sides of the Cascades have polarized Oregonians. Nonetheless, the controversy has brought about significant changes in the way forest lands are allocated and managed. On the west side, serious differences remain concerning the amount, distribution and management of late-successional forests needed to support spotted owls and other old-growth dependent species. No consensus exists on the impact of timber management practices on declining salmon stocks, but most acknowledge they are a component of the problem.

The most significant change in forest policy was made in the early 1990s with the adoption of President Clinton's forest plan for federal lands within the range of the northern spotted owl (primarily west of the Cascades). Under the plan, nearly two-thirds of federal forest lands were designated late-successional reserves, leaving one-third (matrix land) available for timber harvest. The practical effect of this plan has been to reduce the amount of timber harvested on federal lands, thereby shifting part of the state's commercial timber production to non-industrial private lands. To a lesser extent, this shift has occurred on regional private lands and in other countries, especially Canada (Misek pers. com. 1997). Implicit in the plan is a recognition that while late-successional forests will be maintained on federal lands, other lands will be more intensively managed and contain larger areas in early-successional stages.

A similar ecosystem management planning effort has been undertaken for federal lands on the east side, but the outcome remains unknown. Various opinions have been offered to explain the "forest health" problems of eastside forests. Debate continues over the wisdom of salvage logging. A de facto system of zoning has evolved to meet ecological and economic goals. However, many years must pass before policy changes can be fully implemented and overall ecological, economic and other effects can be evaluated.

One of the primary goals of Oregon's land use planning system is to manage the conversion of primary production lands—farmland, and forestland—to other uses. It has been successful to some degree in slowing and directing urban expansion. Oregon was the first state to adopt a forest practices act regulating commercial forest operations on non-federal forest lands. That 1971 law provides for wise management of all forest resources, soil, air, water, timber, fish and wildlife, and aesthetics along designated scenic highways. It is a dynamic statute that has most recently been strengthened in the areas of reforestation, use of chemicals, and water quality support. Advocates of depressed fish populations are closely watching the program's efforts to support fish habitat restoration through practices modified to respond to recent scientific findings about the importance of stream structure and large woody debris (Misek pers. com. 1997).

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A peer-reviewed study of forest management's effects on terrestrial wildlife reports that current forest practices are addressing the correct functions, although only time will determine whether they provide enough habitat. The forest industry-supported commodity commission, the Oregon Forest Resources Institute, commissioned the report (Bunnell et al. 1997).

Road construction and maintenance are recognized as practices key to controlling sediment entry into streams and providing fish passage at bridges and culverts (Bunnell et al. 1997). The Oregon Board of Forestry recently adopted water protection rules to place renewed requirements for fish passage at road crossings on streams. All crossings must be constructed to provide fish passage and old roads must be upgraded when reconstruction is done. In addition, stream crossings must now be large enough to carry the 50-year frequency storm event. In the past, the standard was the 25-year storm event. Program specialists are studying road sediment delivery processes to ensure that construction and maintenance practices are improved, if necessary (Misek pers. com. 1997).

Despite the absence of a policy establishing landscape-scale planning for Oregon's private forest lands, some managers, policymakers and landowners recognize the value of considering the larger context in which site-specific land management decisions can be made. Private landowners and society can

benefit from a broader approach, where federal lands used to meet the requirements of species affected by timber management activities may relieve some pressure on private landowners. At the same time, many wildlife species will prosper in managed forests because they do well in early- and mid-successional stage forests.

CONTRIBUTION OF FOREST LANDS TO BIODIVERSITY

Oregon's managed and "wild" forests are critical to long-term biodiversity conservation. Several of the state's diverse forest communities are well-represented within the existing network of conservation lands. For example, more than half the state's mountain hemlock-Shasta red fir forests and a quarter of the western hemlock-Douglas-fir forests are in wilderness areas or late-successional reserves. Other forest types have been essentially overlooked. Less than five percent of Oregon's white oak and ponderosa pine woodlands are in areas where management emphasizes biodiversity (Oregon Biodiversity Project 1998).

Almost half of Oregon's 641 species of vertebrate animals occur in forests. Of the approximately 100 terrestrial vertebrates at risk in Oregon, 45 are potentially affected by forest practices and 12 of these inhabit riparian habitats. More than 60 species are associated with downed wood, which is especially important for shelter, food, microorganisms and stream structure (Bunnell 1997). Managed forests support a wide

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range of species whose habitat requirements are compatible with early- and mid-successional forest habitats. 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).

Some foresters have suggested that properly managed commercial forestry operations may have less impact on an ecosystem than other forms of intensive development (Rochelle pers. com. 1996). They argue that with commercial forest operations soil and vegetation are disturbed relatively infrequently; that despite the best efforts of foresters to control competing vegetation, native species of hardwoods commonly re-invade managed sites; and that forest management often addresses recreational and aesthetic values, thereby moderating deleterious effects. According to a report sponsored by the Oregon Forest Resources Institute, no evidence exists that current forest practices on private lands immediately threaten any terrestrial vertebrates in Oregon, given the conservation strategies in place on federal lands (Bunnell et al. 1997).

BIODIVERSITY ISSUES AND IMPACTS

Timber harvest can affect wildlife habitat. Although the results of these effects are subject to debate, most acknowledge that timber management (like many other human activities) can

cause long-term changes in native populations of plants and animals, affect the composition of plant communities and affect major ecological processes.

The widespread conversion of diverse, native forest habitats to Douglas-fir-dominated plantations with short rotations tends to eliminate habitat for cavity-nesting species; reduce the amounts of dead and downed wood; and open interior forests to invasive exotic plants, pests and edge-loving animals. Timber harvest can disturb soil, causing erosion and even landslides. Soil compaction can also reduce site productivity. Disturbance of streams and riparian habitat can damage spawning and rearing habitat for fish. The policy of 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 can fragment habitat and open lands to intensive recreation, vandalism and wildlife disturbances.

Not all species have the same habitat requirements, so management practices benefiting some, such as big game, might cause adverse impacts to other species. According to the 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

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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 different programs have emerged in recent years to address concerns about forest management. Ecosystem management is now the dominant 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 the health of all other organisms in and around forests, in addition to soil, water, air and human communities.

Although precise operational definitions and implementation activities differ, some management guidelines have emerged and are broadly supported by diverse constituencies. Specific strategies will vary by region, by site and by landowner objective. However, the guidelines 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 of the impacts are cumulative

and can only be addressed on a region-wide basis. Even though certain management activities (like the creation of forest openings and edge effect) may increase the number of species present in a given area, the overall impact on biodiversity may be negative if habitat needed by species in jeopardy is modified or destroyed. Some impacts will be positive as well. Region-wide plans should be based on a landscape-level assessment of the overall pattern and distribution of different habitat types, and provide for connectivity and maintenance of ecological processes (OSU Extension Service 1996b).

Maintain natural diversity of plants and animals across the landscape. An important goal of many conservationists is to manage for viable, self-sustaining populations of native species region-wide, to the extent that it is possible to do so 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.

Encourage birds and beneficial insects 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).

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Maintain various seral stages across the landscape. 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 what that might be). 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.

Mimic natural disturbance regimes. Native forests are adapted to natural disturbances like fire, flood, wind, ice storms and even volcanoes. 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).

Retain forest structure. 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. Cavity nesters, for example, depend on snags, downed and decaying logs, and associated soil organisms. Green trees can be left standing in harvested sites to become future snags, and

when they inevitably 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).

Protect or restore crevice habitat for bats, including caves, snags, hollow trees. 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).

Modify cutting patterns and increase rotation ages. Cutting patterns can be modified in many ways 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 provides larger trees with better nesting characteristics and more desirable structure for wood in streams after they fall. Thinning smaller and weaker trees will enhance the growth potential of larger trees (Perry pers. com. 1996). Assuming that larger trees will be harvested at some time, a balance is maintained between trees harvested and maintained (Messinger pers. com. 1997).

Reduce potential for fragmentation effects through maintenance of connectivity. Timber harvest, road-building, recreational development, and other activities fragment forest

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habitat. Planning harvests to 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 can also aid in dispersal of seeds and facilitate the re-establishment of vegetation after a disturbance (Logan and Fletcher 1996).

Maintain or restore natural drainage patterns by looking at the impact of roads on water flow. 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).

Protect riparian habitats. 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 filter contaminants, limit sediment and contaminants entering the stream, control flooding and improve water quality. Limiting timber harvest within riparian areas is essential to good forest stewardship. 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 provide large woody debris in the streams for fish habitat. However, managing riparian areas exclusively for conifers to benefit fish could limit the hardwood habitat needed by songbirds (Bunnell et al. 1997).

Restore fish habitat, emphasizing natural recovery. Fish habitat can be improved with in-stream 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 expanded beyond in-stream work to include reduction of upslope and riparian conditions that cause stream habitats to decline (Roper et al. 1997).

Conserve special habitats. Certain habitats—e.g., wetlands, bat caves, talus areas, high cliff areas, roosting and nesting sites—are especially significant to wildlife and should be protected from disturbance.

Control erosion. 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 special techniques to harvest unstable slopes is important to prevent mass wasting of hillsides (Sidle 1980, Adams 1989).

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Minimize road-building and close unneeded roads.

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).

Minimize chemical contamination. Careful and judicious use of herbicides, pesticides and fertilizers will protect water quality and avoid killing non-target species. Compared to agricultural and residential lands, most commercial forests are light, infrequent users of chemicals in forest management activities and are closely regulated by the Environmental Protection Agency.

Reforest sites harvested prior to passage of the Forest Practices Act. Although the Oregon Forest Practices Act requires that private lands be replanted after harvest, this was not always the case. Some areas of the state have significant “brushfields” overgrown with blackberry, Scotch broom and other undesirable exotic species. Reforesting these sites

would improve their commercial and biodiversity value. Planting a diversity of species is preferable to monocultures.

Control invasive exotic species. Certain alien plants—e.g., 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 conduits 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 (BLM 1996c).

Reevaluate fire suppression strategies and use prescribed fire, where appropriate. Aggressive fire suppression in east-side 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 can also be used to remove shade tolerant conifers (Bunnell et al. 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 pers. com. 1997).

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Address forest health concerns. For eastern Oregon, Oregon State University's Extension Service recommends changing the forest composition to encourage more larch and pine, thinning dense stands, using controlled fire, planting high-quality seedlings and encouraging beneficial natural predators and parasites (Oester et al. 1992). In 1995, a scientific team appointed by Governor Kitzhaber recommended a series of other actions to improve forest health in eastern Oregon. The report acknowledges that forest management practices, including selective ponderosa pine harvest and fire suppression, have caused ecological health problems. The recommendations include those listed above plus careful monitoring, active reforestation, road removal and initial avoidance of sensitive sites (Kitzhaber 1997).

EXISTING AND PROMISING INCENTIVES

Commercial Forests

For the purpose of this discussion, commercial forest lands include public and private lands managed primarily to produce revenue from harvested timber. They include private landholdings over 5,000 acres, state forest lands and federal lands 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 industrial landowners need incentives that

are easy to understand and participate in, as well as consistently available and effective for managing timber.

Stewardship certification has been proposed by several non-profit and industry organizations (see boxes on pp. 64-65). Landowners who want third-party certification must meet management standards specified by the agent. One motivation for certification is the potential for "green marketing," based on the assumption that consumers prefer wood produced under sustainable management guidelines, and that they will pay more for products manufactured from that wood. 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 pers. com. 1997).

Although certification has promise, widespread adoption has been inhibited by a number of factors. Demand from consumers has not been vociferous, although polling indicates 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, which are undoubtedly perceived as too onerous by some

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 Council has diverse representation from relevant economic, environmental, and social sectors.

In Oregon, The Rogue Institute for Ecology and Economy works with the Rain forest 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 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, 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

Collins Pine, a family-owned timber company with headquarters in Portland, was the first forest operation to be certified by Scientific Certification Systems, Inc. The company conducted an extensive evaluation of Collins' 92,000-acre forest in northern California. The evaluation, which took about eight months, considered elements of timber sustainability, forest ecosystem maintenance, and socio-economic benefits. The company scored over 80 percent in each category.

No clearcuts exist in Collin's Almanor Forest. 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. V41, no. 7.

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landowners. Also, many lumber mill owners and manufacturers have been reluctant to implement procedures necessary to separate sustainably grown timber from traditionally grown timber. Certification in general is hampered by the existence of several different schemes, each managed according to different philosophies. Confusion in the marketplace is inevitable and may be the single greatest barrier to overall acceptance of the concept (Montgomery pers. com. 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, additional incentives for producers of certified products, and perhaps, a series of specified steps toward certification that can be implemented over time to minimize adverse economic impacts.

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 (Kohm 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 will ultimately perform better in the marketplace. Taking voluntary actions to correct problems may forestall more

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restrictive regulations. Participation in watershed councils and other collaborative decision-making relative to natural resource management will also enhance 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 they are 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 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, and provided plans are carried out, landowners could be exempted from specific laws or regulations. Examples of this strategy include Habitat Conservation Plans, watershed plans and stewardship agreements. These strategies are particularly appealing to landowners who are interested in reducing the uncertainty associated with forest management policies.

Legislation was passed in Oregon in 1997 to offer landowners the opportunity to submit a stewardship plan instead of a written plan for each operation as an alternative to compliance with the Forest Practices Act. The purpose is to encourage landowners to take a broader, ecosystem-oriented approach (Hanus pers. com. 1997). The primary potential benefit to the landowner is a more predictable business environment in which to make investment decisions. It should also encourage landowners to take more responsibility and self-regulate. The potential benefit to ecosystems is a more systematic broad-scale approach to conservation than is generally achieved under a site-by-site, species-by-species approach. Remaining contentious issues include the scientific uncertainty inherent in ecosystem management, the difficulty of effectively monitoring implementation, and the level of responsibility private landowners have to protect “public resources.”

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 track progress. To date, monitoring has been sporadic and piecemeal. Lack of consistent information about the status of forest resources inhibits effective management.

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Land exchanges can be used to meet regional conservation goals. Private lands with important ecological values can be exchanged for public lands more suited to commodity production. A pilot project in Oregon's Umpqua Basin is evaluating this approach (Wright 1997).

Conservation easements, which are restrictions on the use of private land, purchased by public agencies or private organizations, can be used to protect public values on privately owned lands by compensating landowners for lost economic opportunities. Easements are often implemented through deed restrictions, which must be monitored by the sponsoring organization to ensure compliance.

Incentive contracts could compensate landowners for losses associated with managing land for biodiversity values, and guarantee the right to harvest in exchange for reaching certain habitat goals (Lippke 1997).

Small Woodlots

Although many of the above incentives may appeal to small woodlot owners, their circumstances may vary substantially from the larger timber companies. Incentive programs will need to be flexible enough to accommodate substantial differences in the size of ownership, age of landowner, overall economic and other management goals, and other factors. Ownership of the average small woodlot in Oregon turns over

approximately every seven years. 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 often 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 woodlots 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 an emphasis on the production and distribution of user-friendly information on profitable,

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ecologically sound and cost-effective management strategies, is essential. The Service Forestry Program and the Stewardship Incentives Program, administered by the Oregon Department of Forestry university extension programs, provide on-the-ground services to landowners. The Sustainable Forestry Partnership at Oregon State University provides training on sustainable forestry methods.

Special recognition for exemplary land stewards may inspire others to adopt sustainable management strategies. Certification of products harvested from sustainably managed forests may provide important recognition in the marketplace and enhance profitability.

Direct financial assistance, such as cost-share money and watershed improvement grants, may be required in some cases where landowners have habitats of special significance; 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 artifacts, and floral

products. According to the Rogue Institute for Ecology and Economy, “non-timber forest products” can be sustainably harvested more frequently than trees, and represent viable economic opportunities. For example, some researchers believe that salal, which is 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 pers. com. 1997). Improved distribution networks and better technical assistance are needed. More research is needed to determine what level of harvest can be sustainable (Hanus pers. com. 1997).

Managing forests for recreation and wildlife habitat can generate income from various uses—hunting, birdwatching, hiking, etc.—and may also be compatible with some uses 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 pers. com. 1997).

Native Forests

Most of the forests managed explicitly for their natural values are in public ownership. These include federally designated wilderness areas, late successional reserves under the

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 our 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:

Source: American Forest and Paper Association 1996.

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 by 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.

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President's Forest Plan, some municipal watersheds, some state parks and a handful of local parks. Privately owned native forests include some lands owned by The Nature Conservancy and those 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 greatly benefit 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, like the deliberate removal of large woody debris from streams and fire suppression, continue to pose management challenges.

Several incentive options have potential for managers of public and private native forests:

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 is essential. Native forests exist in a larger context, which to a certain extent, helps determine management strategies. The Oregon Biodiversity Project's database and analysis is a reasonable starting point.

Stewardship awards could be given to agencies, individuals or interagency management teams whose conservation of natural forestland is exemplary and serves as a model to others. Providing cash awards to cover the cost of interpretive displays, and promoting restoration efforts would provide additional incentive.

Incorporating stewardship standards into performance evaluations, employee compensation packages and promotions should focus attention on stewardship goals and serve as inspiration to many public employees.

DEVELOPED LANDS

The distribution of Oregon's human population and intensive residential and industrial development is conspicuously uneven. Although the Portland Metropolitan area occupies less than one percent of Oregon's land, it houses over half of the state's population (O'Toole pers. com. 1997). About 70 percent of the total population is concentrated in the Willamette Valley. On the east side of the Cascades, Bend is the largest city, and growing rapidly. A strong economy in recent years, the state's aesthetic and environmental appeal, and other factors have stimulated Oregon's growth rate, which is now double the national average. Over the next 10 years, the state's population is expected to increase by 16 percent (Molander pers. com. 1997).

Oregon's system of land use planning is one of the strongest in the nation, and has focused on managing the expansion of urban and suburban development into rural landscapes. State law requires county governments to develop comprehensive plans that address a number of policy goals, then to submit them to the state for approval. For example, Goal 5, recently revised, addresses the need for parks, natural areas, open space and wildlife habitat. Other goals address the protection of farm and forest land, transportation and other issues. Each city or regional government must establish an urban growth boundary to constrain intensive development and limit sprawl.

CONTRIBUTION OF DEVELOPED LANDS TO BIODIVERSITY

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

The developed landscape also supports some elements of biodiversity more directly by providing habitat for some wildlife species, including endangered ones. The peregrine falcon, a federally listed species, nests under bridges and on ledges of Portland's high-rise buildings from where it hunts pigeons and other birds. Bald eagles winter near Sauvie Island, just outside the city's boundaries, and nest on Ross

DEVELOPED LANDS

Island, in the heart of the city. Salmon and steelhead still spawn in Willamette Valley rivers and streams. Over a hundred species of birds, including some unusual species like band-tailed pigeons and pileated woodpeckers, make use of suburban areas within the Willamette Valley (ODFW 1993). Backyards, managed with wildlife habitat values in mind, also contribute (O'Toole pers. com. 1997).

The most important focus of biodiversity programs in urban areas should be to help people gain a better understanding of 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 the room, recycling and riding the bus may not make a dramatic impact, making the choices and acting on them is an important step toward a more sustainable society. Through 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, where impacts 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.

This chapter 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 things to think about and to do, which will make a difference within the context of their daily lives.

BIODIVERSITY ISSUES AND IMPACTS

Urban development has had more extensive and profound impacts on native biodiversity than any other land uses, 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.

From a regional perspective, biodiversity has been affected the most in the Willamette Valley, where several habitat types have been virtually eliminated. Native Willamette Valley prairie, bottomland hardwood, oak woodland and riparian forest persist only in small patches, covering a small fraction of their original ranges. Water quality, although dramatically improved since the 1950s, fails to meet federal standards in numerous streams, many of them contaminated by urban uses.

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STEWARDSHIP PRINCIPLES AND MANAGEMENT RECOMMENDATIONS

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. Portland Metro's Greenspaces program, approved by voters, outlines an ambitious strategy to purchase open spaces and connect them with trails and greenways (Metro 1995). Eugene's strategy to create a connected system of wetland and upland habitats encompassing over 14,000 acres could become a reality within the next decade (West Eugene Wetlands Project 1997).

The arrangement of natural areas should consider the potential benefits associated with linking greenspaces. Avoiding development in sensitive habitats like wetlands, floodplains 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 non-point sources. Watershed-level planning addresses a 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 by using native or "native-compatible" plants 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 (e.g., English ivy, Scotch broom, and Himalayan blackberry) is an important element of biodiversity management.

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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 SPECIFIC TO DEVELOPED LANDS

Commercial and Industrial Landowners

A number of actions can be taken by industrial and commercial landowners to help meet regional conservation goals:

Participate in watershed planning to identify the highest priority conservation actions within a regional context.

Participation and willingness to provide assistance to local organizations may enhance community support and help prioritize conservation actions.

Establish a mitigation bank for habitat funds to allow 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 an effort to implement them on- and off-site.

Homeowners

Homeowners can take steps to conserve biodiversity, and might be encouraged to do more if incentives were available. Some options follow:

Education is an important first step. 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. The Naturescaping program, operated by the Oregon Department of Fish and Wildlife, is very effective and could reach a larger audience with more staff support (see next page).

Land trusts offer benefits for landowners willing to donate property, or sell at less than market value, to a trust for preservation so the landowner 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.

Planning and coordinated actions by landowners can produce greater ecological benefits than if each landowner acts individually. Plans can be developed at the neighborhood, watershed or county level.

Tax incentives may motivate people to implement stewardship guidelines. For example, counties could reduce property

NATURESCAPING

Oregonians interested in attracting wildlife to backyards, farms, and even to commercial and industrial properties can follow guidelines offered by the Oregon Department of Fish and Wildlife in *Naturescaping: A Place for Wildlife* (Hirose et al. 1992).

Provide some food. Native plants with fruits, berries, seeds, nectar and nuts will attract a variety of animals and require less water and care than introduced plants.

Water attracts more wildlife than specialized food. Building a pond, conserving a wet area, or placing a bird-bath in the yard is a good start.

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 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 as insects prefer weak plants. Use insect-resistant plants, and when necessary, biological controls.

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 3,000-7,000 insects a night.

Source: Hirose et al., 1992. *Naturescaping: A Place for Wildlife*. Oregon Department of Fish and Wildlife, Portland, Oregon.

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taxes by one percent for homeowners who follow conservation guidelines for water use, chemicals, native plants, etc., and two percent for homeowners who follow guidelines and whose individual activities are also consistent with a larger urban plan. A similar incentive is Portland's policy of reducing sewer rates for homeowners who disconnect downspouts.

Establish license requirements for outdoor cats to encourage people to keep cats indoors, thereby reducing predation on birds. Neuter cats and discourage proliferation of feral animals by limiting access to food sources (Coleman et al. 1997).

Private certification programs like the National Wildlife Federation's backyard habitat project can help people learn about wildlife and habitat needs by direct participation (Tufts 1988).

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).

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Schools

Schools have many opportunities to participate in conservation programs. For example: Students and other volunteers can participate in restoration and clean-up efforts that encourage awareness and sensitivity toward natural ecosystems.

Cemeteries

Change management practices to make cemeteries more biodiversity-friendly. For example, use native plants in landscaping, convert lawn areas to grasses with lower watering requirements, and reduce the use of chemicals in grounds maintenance. Planting butterfly gardens might be an appropriate and compatible use.

Establish a revolving fund to purchase natural areas in honor of the deceased. Donations (roughly equivalent to the cost of a traditional casket, funeral and cemetery plot) could be pooled to purchase land. A name plaque could be posted and an outdoor service held to honor the deceased.

CONSERVATION LANDS

Oregon's extensive conservation and recreation lands are a treasured part of the state's heritage, contribute to quality of life and are essential to the tourism economy. These lands include one national park, several national monuments, national wildlife refuges, wilderness areas, scenic waterways, state parks and wildlife areas, and many local and regional facilities. Portland's regional government has recently established a "greenspaces" program, and is making major investments in urban parks and natural areas.

The private sector also owns and manages conservation and recreation lands. For example, The Nature Conservancy has 52 preserves statewide, totaling over 50,000 acres. These lands are managed primarily for their natural values, with biodiversity conservation as a major goal. Although not managed explicitly for biodiversity purposes, golf courses, resorts and other privately owned outdoor recreation facilities represent an important piece of the biodiversity puzzle, and may become more important in the future, particularly near population centers where open space is in great demand.

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. Crater Lake National Park and most of Oregon's state parks and coastal areas were not established with biodiversity goals

CONSERVATION AND RECREATION LANDS

in mind. Most federal wildlife refuges are intended to conserve habitats for migratory birds. Federal wilderness areas tend to be at high elevations where valuable timber is sparse. Some regions, particularly those east of the Cascades, have very few lands in the conservation network, even though much land is in public ownership. And certain habitat types, like low-elevation riparian areas, oak woodlands and native grasslands, are generally in private ownership and 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 (Oregon Biodiversity Project 1998).

Conservation and recreation lands vary widely in their geographic distribution, size, level of development, management objectives, ownership and other attributes. Although all are managed differently according to unique circumstances, each has issues in common. These are summarized below, and are intended to give managers some things to consider when developing stewardship plans to improve biodiversity.

BIODIVERSITY ISSUES, IMPACTS AND MANAGEMENT RECOMMENDATIONS

Manage larger landscape units. Many of Oregon's 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).

Include all major habitat types in the network of conservation lands. The Oregon Biodiversity Project has identified a number of major habitat types that are unrepresented or underrepresented in the existing conservation network. This information can be used to help landowners and managers decide how to prioritize conservation actions including acquisitions, land trades, partnership agreements and ecological restorations. In evaluating Oregon's conservation network, factors such as the optimum size of each area and potential connectivity with other sites are important considerations (Oregon Biodiversity Project 1998).

The maintenance of natural disturbance regimes has not been a primary management goal of 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. However, where possible to manage, natural disturbances are important to ecological integrity (Noss and Cooperrider 1994).

Evaluate streams, rivers and creeks that have been modified to determine where it might be appropriate to restore natural hydrology. For example, officials at Willamette Mission

CONSERVATION AND RECREATION LANDS

State Park are investigating the possibility of reconstructing an old oxbow in the river (Gregory pers. com. 1997).

Avoid over-developing recreational areas and 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).

Manage visitors to minimize adverse impacts. Simply explaining to people why they should avoid certain harmful activities or make a special effort to do positive things may have some impact on behavior. Restricting access to sensitive areas during certain times, like nesting season, may be sufficient (Larson 1995).

Inventory and protect sensitive areas where rare plants or animals are located. Such areas could be wetlands, riparian areas, bat caves, nesting or roosting sites. Visitor use should be limited, carefully monitored, and in some very sensitive cases, excluded from these areas (Hudson 1992).

Conserve water by relying on native landscaping and only watering those areas where native landscaping is not appropriate, like play fields and picnic areas. Water can also be recycled, and irrigation systems can be designed to reduce

loss and to water only when necessary. Some grasses, like fescue, take less water than other types.

Minimize use of chemical herbicides, pesticides and fertilizers to save money, protect water quality and avoid harm to non-target organisms. Implementation of integrated pest management strategies is important to biodiversity.

Evaluate secondary land uses (e.g., grazing, agriculture, timber harvesting) to determine whether they are causing adverse impacts, and if so, how they can be modified or eliminated.

Avoid using exotic plants in landscaping and take steps to control invasive exotics in park and natural area management. Using volunteer labor to help remove unwanted plants, like 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.

Provide a good example and public information. This is one of the most important contributions conservation and recreation land managers can make to overall efforts to protect sustainable ecosystems. Demonstration projects; cooperative agreements with adjacent landowners; high-quality interpretive signing; well-informed staff naturalists and

CONSERVATION AND RECREATION LANDS

volunteers; and partnerships with schools, scientists, conservation groups and local businesses can all help to meet biodiversity goals.

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

EXISTING AND PROMISING INCENTIVES

Provide better information about biodiversity and ecosystem management to agency personnel, private organizations and commercial managers. Interagency, interdisciplinary workshops on information and new management techniques may be productive and cost effective (Sjulin pers. com. 1996).

Provide broad-based funding for most resource management programs. Revenue for resource agencies often comes from user fees (like hunting and fishing licenses, camping or day-use charges) or from commercial activities on conservation and recreation lands. The effect has often been for the revenue source to drive programs, which leaves 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 pers. com. 1996).

Develop management plans to help 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 pers. com. 1996).

Initiate stewardship certification programs, which may be appealing to both public and private managers. For example, several Oregon 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 next page).

Incorporate stewardship standards into performance evaluations, employee compensation packages and promotion consideration to focus attention on goals and serve as an inspiration to employees, both public and private.

AUDUBON COOPERATIVE SANCTUARY PROGRAM FOR GOLF COURSES

Audubon International, located in Selkirk, New York, has developed a certification program for golf courses. The program promotes ecologically sound land management and resource conservation by recognizing and supporting participating operations. Certification is granted in six categories, which can be undertaken one at a time. The categories and management guidelines are summarized below.

Environmental planning sets the stage by evaluating current management strategies, defining goals and priorities, and outlining objectives for the other areas.

Wildlife and habitat management encompasses management of non-play areas to provide habitat for wildlife on the golf course, and provides the following suggestions: Naturalize non-play areas by leaving woodland understory for cover, leaving dead trees standing when not a safety hazard, creating brush piles for small animals, and mounting

and monitoring nest boxes and osprey platforms. Protect or enhance wetlands and other special habitats. Provide food sources for birds, etc. Protect threatened and endangered species. Emphasize native plants in landscaping. Buffer shorelines around ponds and other water bodies with aquatic vegetation.

Integrated pest management addresses the use of proper pest management practices, including chemicals used in building maintenance. It includes the selection of appropriate turf for climate and soil; use of cultural practices to improve turf health, careful monitoring of pests and emphasis on least-toxic pest control strategies, and use of slow-release or natural organic fertilizers. It also addresses the need for careful record keeping and staff training.

Water conservation includes the installation of modern irrigation systems, which are designed for maximum efficiency and to operate only when watering is necessary; to capture and

reuse irrigation water; to use drought-tolerant plants and replace unnecessary turf with other landscaping; and, to use mulches for reducing water loss to evaporation.

Water quality management seeks to prevent or reduce nutrient loading and pesticide contamination of water sources. It also addresses the maintenance of vegetative buffers around water to prevent runoff and reduce erosion. Wetland protection and enhancement are encouraged. Proper equipment maintenance and water quality monitoring are required.

Outreach and education efforts are designed to display information about certification, and can include a wide range of communication tools: newsletters, brochures, press releases, seminars, workshops, etc. They can also include public involvement in nest box construction and monitoring, planning, habitat restoration, trail construction and developing nature guides.

Adapted from: Audubon International, 1996. Certification Workbook, Audubon Cooperative Sanctuary Program for Golf Courses. Selkirk, New York.

TRANSPORTATION AND UTILITY CORRIDORS

Oregon's extensive network of roads includes approximately 50,000 miles of highways and streets built primarily for transportation. An additional 70,000 miles of roads have been constructed in Oregon's national forests. Information on roads built on private lands is not available, but the figure could be as high as another 65,000 miles. While the total number of highway miles has not expanded much in recent years, forest roads have more than tripled in Oregon since 1960 (Ryan 1995). To put these numbers in perspective, Oregon has approximately 80,000 miles of streams, including intermittent ones.

BIODIVERSITY ISSUES AND IMPACTS

The impact of these roads on Oregon's 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 weeds (invasive exotic plants) via roads. The tires of vehicles driven in weed-infested areas pick up seeds and transport them great distances.

Highways can adversely impact large carnivores like 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. The upgrading of roads (paving, addition of new lanes, 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. The Willamette Valley, for example, has roadside areas containing rare plant species (Macdonald 1997).

Utility corridors have negative impacts similar to roads, particularly with respect to habitat fragmentation. When located in forested areas, the continuous vegetative community is disrupted, 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 impacts of utility and transportation corridors, some common themes emerge:

Using existing corridors or placing new roads along unused corridors will help prevent additional habitat fragmentation (Ruediger n.d.).

Minimizing edge effects should be a goal of corridor management. While edge habitats benefit some species, and sometimes create opportunities for new species, the overall

TRANSPORTATION AND UTILITY CORRIDORS

impact can be negative if predation or disruption of sensitive species habitat is increased (Gates 1991).

Road decommissioning and closure are a necessary part of a biodiversity strategy (Ruediger n.d.). Many watershed councils, resource agencies, and private companies have identified non-essential 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 avoid contamination of waterways and harm sensitive wildlife species (ODOT 1996).

Using native species to revegetate disturbed areas will improve habitat quality and could reduce maintenance costs. Landscaping with “native compatibles” can achieve similar objectives. For example, wildflowers have considerable aesthetic appeal; are low maintenance; and are attractive to butterflies, insects and birds. Avoiding wildflower mixes containing noxious weeds will help control their expansion.

Controlling the spread of invasive exotic plants and animals should be an emphasis in corridor design, placement and maintenance (BLM 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. Use of 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. Considering mitigation more broadly (including off-site and “out-of-kind” mitigation) would provide more flexibility by directing investments to most ecologically significant projects, not just to projects on or near the site of impact (Taylor pers. com. 1997).

SPECIFIC MANAGEMENT RECOMMENDATIONS

Highways, Streets and Forest Roads

Beyond the general highway management issues identified above, more specific actions are being taken to conserve biodiversity. Most of the recommendations below are adapted from *The Road to Recovery: Transportation Related Activities and Impacts on Salmon*, a video produced by the Oregon Department of Transportation for people who build and maintain roads. Many of these actions are being implemented under the Oregon Coastal Salmon Initiative (ODOT 1996).

Avoid dredging and filling activities in fish-bearing streams, especially during spawning season.

TRANSPORTATION AND UTILITY CORRIDORS

Make sure herbicides and pesticides do not enter the water. A 25-foot buffer is recommended for machine application and a 10-foot buffer for hand application.

Install culverts to allow fish passage, and modify existing culverts, as necessary. Culverts that concentrate high-velocity flows and those that cause severe erosion at the outlet end may hamper fish passage. Fish-friendly culverts have a gradual slope, small pools below, and a series of dams to allow fish migration.

Avoid removing riparian vegetation; leave large woody debris in and along streams.

Be careful when sanding roads. Angular, abrasive gravel that washes into streams can harm spawning fish.

Prevent road waste and construction materials from entering the water. Water should be directed through vegetation filters before entering streams.

Control erosion so that sediment does not enter the water. Settling ponds and hay bales can be used to control and direct runoff. Planting grass in ditches can help purify water, reduce flow and minimize the need for chemicals. Special varieties, like red fescue, do not require frequent mowing or other maintenance, and are being used on an experimental basis.

Maintain beaver dams (unless they directly threaten roads by blocking culverts or other similar structures.) Beaver dams generally enhance overall aquatic ecosystem health.

Utility Corridors

While utility corridors and roads share some common guidelines, the former have some unique guidelines, discussed below (Gates 1991).

Feather the edges of powerline corridors to minimize edge effects. Create successional bands of vegetation in varying heights parallel to the corridor to disperse both predators and prey species. (However, this technique could reduce the amount of interior habitat for locally sensitive species.)

Reduce the effective width of corridors. A small change in impermeable edge can produce a major change in the ability of animals to move. Create small lobes or peninsulas of shrubby vegetation extending from the forest edge into the corridor.

Establish breaks in the corridor. This can be accomplished by leaving some vegetation along low creeks or draws that traverse the corridor. Alternate spraying to retain some vegetation at all times.

TRANSPORTATION AND UTILITY CORRIDORS

Establish shrub communities throughout the corridor.

Although initially difficult to establish, shrubs are easy to maintain once established and require less attention than herbaceous cover.

Maintain seasonal vegetation in corridors during certain seasons to accommodate the needs of animals during periods of reproduction and dispersal of young (principally, spring and fall).

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 public and private sectors.

Stewardship awards 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, employee compensation packages and promotion consideration to focus attention on goals and motivate public employees. Writing stewardship guidelines into

construction contracts, or giving special consideration to contractors with experience with 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 may encourage companies to take action and voluntarily implement management guidelines.

Closing unneeded logging roads may help the salmon recovery effort. 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—address road and utility corridor management in the context of other land uses.

MINERAL LANDS

Approximately 61,000 acres, or 0.1 percent of Oregon's lands have been disturbed by mining practices. Current mining activity consists of approximately 750 sand and gravel, 13 placer, and 5-10 industrial mineral mines. About 3,500 mining sites have been abandoned (Mineral Policy Center 1996). Reclamation efforts have been minimal, with only one abandoned coal site addressed by the U.S. Office of Surface Mining. Two uranium sites are under review for reclamation by the Forest Service and various state agencies (Oregon DOGAMI 1996). The state's major regulatory agency is the Department of Geology and Mineral Industries, whose resources support only four state mine inspectors to oversee nearly 800 inspectable units (Oregon DOGAMI 1996). Total estimated reclamation costs are \$57-\$77 million dollars, including costs associated with polluted water, mine dumps, disturbed land, mine openings, highwalls and hazardous structures. This does not include uranium overburden mines, mill sites or waste dumps (Oregon DOGAMI 1996).

BIODIVERSITY IMPACTS AND OPPORTUNITIES

Hard rock mining operations can pose serious threats to the health of both aquatic and terrestrial systems. In terrestrial systems, mining activities physically alter and fragment 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 landscape

(Mineral Policy Center 1995). In cyanide heap leaching operations, birds and other wildlife can be exposed to chemicals lying in storage ponds. Thousands of waterfowl deaths have been reported from cyanide poisoning related to mining activities (Mineral Policy Center 1989).

Aquatic systems are threatened by four primary factors:

Acid mine 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).

Heavy metals contamination (e.g., lead, cadmium, arsenic, mercury, and aluminum) of waterways via stormwater can cause fish kills and water sterilization (Kelly 1988).

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).

Chemical process pollution is most commonly associated with the gold mining practice of cyanide heap leaching. 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).

MINERAL LANDS

Even **small-scale placer mining operations** can cause adverse impacts on aquatic ecosystems. A report by the Division of State Lands identified disruption of fish migration and spawning grounds, destruction of salmon eggs and young fish, stream siltation, damage to riparian vegetation and changes to stream channels as issues of concern relative to endangered fish. The cumulative effects of many small operations along with other disruptive activities on the landscape are poorly understood (Oregon Division of State Lands 1996).

Aggregate mining operations (sand and gravel) in streams and rivers can alter the channel contour, 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 streambank shaping and the creation of side channels to improve fish habitat. Possible use of adjacent floodplain ponds (created by gravel mining) for flood refuge needs to be explored (Gregory pers. com. 1997). Along the Willamette River, many opportunities exist for mutually beneficial partnerships between aggregate companies, agencies and private organizations to reconnect the river and its floodplain, and to protect and enhance riparian and wetland habitats. Several sand and gravel companies have donated previously mined

lands to the state for park use, and additional donations are being explored (Meinen pers. com. 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

Mining in Oregon is heavily constrained by state statutes and regulations, so it is likely that future activities will be limited. The permissive Federal Mining Act of 1872 does provide mining access to most federal lands, and does not require significant compensation to taxpayers for the minerals extracted, nor cover the costs of reclamation. Debate over this controversial statute is expected to continue.

The Mineral Policy Center in Washington, D.C., proposes amending the 1872 Act. The Center also offers the following guidelines on issues to be addressed for responsible mining (Mineral Policy Center n.d.):

Overflow management is needed to prevent overflow of storage ponds containing harmful chemicals during heavy rainfall.

Silt can be controlled by diverting streams and runoff from the mining site to prevent excess amounts of silt from entering waterways.

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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 the operation is finished (California Council on Biodiversity 1995a).

Reshaping the landscape to its original shape, and removing man-made objects can enhance its appearance and biodiversity value (California Council on Biodiversity 1995a).

A biological assessment prior to modification or closure of existing mines will determine appropriate actions relative to **protecting bats using mines**. More than half the 43 species of bats living in the continental United States roost in abandoned mines. This includes some threatened and endangered species. Closure of old mines without biological assessment could eliminate some of America's largest bat populations. Installation of "bat 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).

MINERAL LANDS

The Division of State Lands regulates **small-scale placer mining in essential salmon habitats**. Some of the management guidelines would apply to aquatic habitats not subject to the regulations. For example, operators should avoid the following:

- Removing large amounts of material from streams;
- Constructing permanent dams or blocking entire streams;
- Disturbing plants growing on sand or gravel bars and streambanks;
- 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 Lands 1996).

EXISTING AND POTENTIAL INCENTIVES

The unique nature of mining regulation in Oregon limits the applicability of incentives to this land use. However, several possibilities exist:

Stewardship certification may be appealing 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. For example, Morse Brothers, a sand and gravel company in the Willamette Valley, is working on creating habitat for the endangered western pond turtle on a site formerly used for aggregate mining (Morse pers. com. 1997).

Financial incentives or in-kind assistance 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.

Restoration of abandoned sites, where funding is available, could provide employment for people in rural communities.

Awards can be offered to operators exceeding state requirements. The Department of Geology and Mineral Industries already offers awards to companies that do an exceptional job. Special recognition from other agencies and organizations may encourage additional investments (Lynch pers. com. 1997).

MINERAL LANDS

Financial incentives may encourage land donations to resource agencies or nonprofit organizations. Used 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 pers. com. 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 pers. com. 1997).

OREGON'S 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 disproportionate value to wildlife, supporting a greater variety and abundance of plant and animal species than surrounding lands, especially arid lands. Invasive exotic animals and plants are highlighted here because of the serious threats they pose to Oregon's native ecosystems. Both issues need to be addressed in a holistic, integrated way.

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 state, 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 insuf-

ficient because water flows across all ecosystems regardless of their management. We need to think about water and its relationship to the land more holistically, and generally avoid the separation that has created so many problems.

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 excess nutrients, bacteria and chemical contaminants. Many species of wildlife depend on wetland and riparian systems for food, shelter and water. More than 70 percent of the animal species that occur in Oregon's coniferous forests use wetlands at some stage of their lives. Oregon's estuarine and riverine wetlands are critical to salmon and steelhead (Leibowitz 1995).

BIODIVERSITY ISSUES AND IMPACTS

Many aquatic and riparian systems are in jeopardy. From the Cascades west to the Coast Range, many aquatic and riparian-dependent fish and wildlife species are in trouble (Willamette Riverkeepers 1996). On the east side, some riparian areas have been heavily degraded by improper grazing. Statewide, approximately 38 percent of Oregon's wetlands—over one million acres—have been converted to agricultural, commercial and other uses (Leibowitz 1995).

Many of Oregon's major waterways have been substantially modified by human activities. The hydrologic and ecological functions of many rivers have been changed forever by dams and other in-stream devices. The natural seasonal flows that once inundated entire valleys, depositing sediment and rebuilding the land, have been contained. Floodplains have been diked and drained for agriculture, and cleared of natural vegetation for pastureland and cropland. Urbanization has modified wetland systems even more drastically. Streams have been re-routed, channelized, forced through pipes and rip-rapped to accommodate human development. Over half the tidal swamp and marsh area along the Columbia Estuary has been lost since the dredging, filling, diking and channeling of the river began in 1880s.

The allocation of Oregon's water resources has a profound impact on biodiversity. Withdrawals for irrigation are given historical preference under Oregon's water laws, causing many streams to be depleted in times of drought. Even during

average water years, the temperature in streams with low water can become too warm to support fish. Industrial uses also make heavy demands on water resources. The competition for water will intensify as Oregon's population grows.

Although water quality in Oregon has improved dramatically during the last few decades, with large industrial pollution sources essentially under control, threats continue from more dispersed sources. Sedimentation and chemical contamination from construction sites, streets, homes, industrial facilities, farms and forest lands threaten water quality statewide. Excessive nitrogen from fertilizers, human and animal waste, and some industrial sources cause the growth of oxygen-depleting aquatic plants, like algae, which harms fish (Mueller et al. 1996). The Environmental Protection Agency has listed 870 Oregon streams in violation of the federal Clean Water Act (Schaedel pers. com. 1997).

The deliberate and accidental introduction of non-native aquatic organisms has taken a toll on Oregon's native fishes and amphibians. For example, the native bull trout, a federally listed species, is adversely affected by interaction with introduced species, especially hybridization and competition with introduced brook trout (Ratliff and Howell 1992). The decline in native salmon and steelhead is attributed in part to the introduction of non-native fish (Nehlsen et al. 1991). Nationally, introduced species were listed as a contributing factor or continuing threat in 70 percent of the species listed under the Endangered Species Act (Lassuy 1995).

Many actions are needed to conserve biodiversity in Oregon's aquatic ecosystems. Some of these activities have been initiated and are underway. Most notably, major investments are being made by local governments to improve the treatment of wastewater through expensive modifications to municipal facilities. Watershed councils have been organized in nearly a hundred Oregon watersheds to address problems with water quality and quantity, and fish habitat. The Governor's Coastal Salmon Initiative (now the Oregon Plan) calls for major investments in projects and technical support to assist landowners in implementing improved management practices in upland and riparian lands. Federal agencies have initiated programs to assist livestock operators in restoring degraded wetland and riparian ecosystems. Private organizations, like the Pacific Rivers Council and River Network, have made major investments in programs to increase public awareness and improve policies to protect river systems. Many industries have contributed staff and money to improve habitat. The Oregon Forest Practices Act was recently amended to improve conditions along Oregon's streams.

However, Oregon still lacks a coordinated approach to conserving wetlands and riparian lands. "Many observers believe that federal and state regulatory programs aimed at protecting wetlands are not comprehensive, consistent, or sufficiently effective" (Leibowitz 1995). Goal 5, under Oregon's statewide planning law, fails to protect wetlands because local jurisdictions lack the technical information and policy guidance to

develop riparian and wetland strategies within the larger context. Although the legislature adopted several policies in 1989 designed to improve coordination of wetland conservation efforts, programs have not been adequately funded. A Division of State Lands report also concluded that more non-regulatory, incentive-oriented approaches are needed (Leibowitz 1995).

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.

Restore proper aquatic and riparian system functioning.

The National Riparian Service Team, jointly managed by the Bureau of Land Management and Forest Service, has developed a "qualitative, yet 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 outputs (forage, habitat, etc.) on the theory 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 streambanks 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 and communication tool for diverse participants to evaluate streams on the ground. The riparian team also assists participants in untangling red tape that inhibits implementation of improved land management strategies (BLM 1996b, BLM and USDA Forest Service 1997).

Manage aquatic systems at the watershed scale. 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 like ecology, forestry, range management and hydrology (Roper et al. 1997).

Reconnect 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 pers. com. 1997).

Ensure adequate water quantity to support fish and wildlife. Although Oregon law recognizes the importance of maintaining in-stream flows, the reality is that water is over-appropriated from many streams.

Maintain water quality by controlling erosion and reducing runoff containing harmful chemicals, fertilizers and contaminants.

Maintain cool water temperature conditions during summer by encouraging woody streamside vegetation on sites where these species are adapted, and/or by applying management that improves the stream's depth-to-width ratio (Svejcar pers. com. 1997).

Restore riparian and wetland vegetation in specified zones. Different zones could be established along streams and rivers to help focus and prioritize restoration efforts based on ecological potential, land use, condition, level of development, degree of flood risk, cost and other factors. Consider variable widths and specify desired characteristics. For example, in some zones, a goal of a 25-foot native or non-native riparian vegetative buffer could be the target. In other areas, a grass filter strip might be adequate.

Protect streambanks in areas of severe erosion. In the long run, restoring the natural functioning of streams is more cost effective than employing rip-rap and other streambank protection measures. Historically, approximately 80 percent of in-stream structures have failed (Elmore pers. com. 1997).

Protect and restore fish habitat. Create side channels, add spawning gravel, place large woody debris in streams to restore fish spawning, rearing and feeding areas.

Provide structures for fish passage and screening for fish deterrence. In some cases, small ladders or dams can facilitate fish migration beyond impediments. Screening keeps fish from being sucked into irrigation canals where they often die.

Leave beaver dams in place, if possible, since they generally enhance the health of aquatic ecosystems.

Water impoundments can be either beneficial or harmful, depending on landowner objectives. 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, attract unsuspecting mammals that are unable to escape from deep ponds, or become stagnant and infested with algae.

Limit or eradicate exotic organisms in aquatic systems. In some cases, it may be necessary to remove exotic fish if they cause adverse impacts to native species. Avoid introducing exotic organisms.

Remove drain tiles and dikes to restore natural water flow and associated floodplain/wetland habitat.

Keep garbage, fill out of wetlands and streams to maintain water quality.

Keep vehicles out of wetlands and streams to avoid disturbing wildlife and degrading habitat.

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, as we suggest, 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, and are discussed below.

Develop watershed and basin plans that address aquatic and riparian issues in a broader 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). Identify and designate priority areas based on functional value and representative type, then provide long-term protection.

Integrate wetland regulations at the local, state and federal levels 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).

Streamline permitting for wetland enhancements to help 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 exists now to some extent, and should be continued and expanded.

Restructure mitigation programs to accomplish greater ecological benefits for the same cost. When essential habitats are destroyed, payment could be made to a fund, with expenditures allocated to highest priority projects. This approach may require revision of Oregon statutes relating to mitigation banking (Leibowitz 1995).

Improve stewardship of aquatic and riparian systems on public lands 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 pers. com. 1997).

Improve information about the location and relative importance of wetland habitat to help landowners manage aquatic and riparian systems properly (Leibowitz 1995). This includes highlighting important linkages between lands (Gregory pers. com. 1997).

Expand direct investments in aquatic and riparian system restoration. These could include 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.

Provide dedicated funding for aquatic and riparian system conservation. Many conservation programs are not as effective as they could be due to lack dedicated funding.

Develop guidelines for best management practices for aquatic and riparian systems (Leibowitz 1995). Use existing and new guidelines to educate landowners about management practices and to encourage their adoption.

Encourage alternative crops in riparian zones within agricultural areas. Examples include hybrid poplar, wild rice and meadowfoam (McAllister 1996).

Provide technical, financial and marketing assistance to landowners interested in maintaining riparian areas and harvesting riparian products (e.g., black walnuts, floral and nursery products, mushrooms, and plants with medicinal and pharmaceutical properties) (McAllister 1996).

Assist landowners in providing low-impact, fee-access recreational opportunities in aquatic and riparian areas. Access for fishing and bird watching is in great demand, especially in populated areas (McAllister 1996).

Establish a high-risk zone within selected floodplains, and develop plans to direct federal flood-relief investments to relocating structures and restoring ecosystems. For example, federal flood insurance could provide 50 percent reimbursement for rebuilding flood-damaged structures within a floodplain, and full reimbursement to locate them elsewhere. No reimbursements would be paid if the owners of structures in floodplains have already been reimbursed (Gregory pers. com. 1997).

Modify criteria for bank loans and qualifications for public agricultural subsidies to reward farmers who protect riparian floodplain habitat (Gregory pers. com. 1997).

EXOTIC ORGANISMS

BIODIVERSITY ISSUES AND IMPACTS

Problems with exotic organisms exist to various degrees throughout Oregon and across all land uses. The accidental or deliberate introduction of alien plants and terrestrial animals, fish and invertebrates has been going on for thousands of years. However, introductions have accelerated over the past hundred years as human populations have become more mobile. Many nineteenth century introductions were made by people unaware of the consequences (see carp and house sparrow introductions, below). People need to recognize these invasive pests, to appreciate the damage they can cause and to participate in efforts to keep them from destroying Oregon's gardens, agricultural crops and native ecosystems.

Of the known and thriving animal species introduced into Oregon, two are amphibians, 33 are fish, 10 are birds, and 15 are mammals. The most striking statistic concerning these introductions is that 35 percent of our present-day fish species are not native to Oregon—the result of mostly deliberate introductions to the state, or to neighboring states where they subsequently spread to Oregon. In most cases, these exotic animal introductions were made by agencies or individuals to satisfy sport fishing and hunting desires. Sixty-four percent of Oregon's sport fish and 50 percent of Oregon's upland game bird species are exotics. Invasive exotic plants are still commonly sold for landscaping purposes, and imported nursery stock is a source of alien slugs and other non-indigenous pests.

Not all exotic organisms are harmful. In fact, most of our agricultural crops, livestock, pets and landscape plants originated elsewhere and are easily contained in desired locations. However, a few notable examples of 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 non-indigenous 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).

INVASIVE PLANTS

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

European beach grass was deliberately introduced to stabilize Oregon's coastal dunes. While it has succeeded in stabilizing foredunes along the beaches, it has greatly disrupted dune ecosystem processes. Its dense structure also provides havens for skunks and foxes that prey on the threatened snowy plover.

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 the Basket Slough National Wildlife Refuge.

Gorse is a highly competitive plant with an oily composition that increases fire hazard. The widespread presence of gorse around the coastal town of Bandon 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 compet-

itive with native rangeland plants, it forms dense monocultures and increases fire hazards.

Yellow star-thistle has invaded much of eastern and southwestern Oregon. It is a prickly inedible plant that is destroying rangelands, recreation sites and natural areas. Yellow Star-thistle was apparently introduced by beekeepers because it produces abundant nectar (Robbins et al. 1940).

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

Himalayan blackberry is the most common introduced blackberry in Oregon, and forms dense impenetrable thickets, generally in disturbed areas. Vigorous, erect canes can grow 20-30 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 in eastern Oregon.

INVASIVE ANIMALS

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

European green crabs have invaded Coos Bay, a southern Oregon estuary. 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 Oregon lakes and reservoirs, generally for the purpose of consuming oxygen-depleting algae. However, carp are quite destructive, plowing up marsh bottoms when feeding, making waters too turbid for the propagation of native plants important to waterfowl, and destroying the nests, eggs and young of other fish.

Striped bass can grow quite large and are a popular food and game fish native to the Atlantic Coast. They are voracious feeders.

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.

Brook trout were introduced for sportfishing purposes, and tend to compete with native bull trout for habitat. There is also a potential for inter-breeding (Myron pers. com. 1997).

Bass, walleye, and shad are introduced warm water fish found in the main stem of the Columbia River. These exotic fish are major predators of salmon and steelhead smolts.

Bullfrogs were introduced deliberately as a food source. They are an aggressive warm water marsh competitor that prey on native amphibians. Bullfrogs are believed to have caused local extirpations of the northern leopard frog, spotted and red-legged frog. They also eat young western pond turtles—an imperiled species—as well as birds and small mammals.

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, they became the most abundant bird species in all of North America, and one of the 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 to Oregon as a game species. They may compete with 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 throughout the world, almost anywhere people live. They carry disease, destroy crops and are a general nuisance.

Nutria are rodents native to South America, introduced first to the Lower Mississippi and then to Oregon 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. They occupy marshy areas statewide, and tend to be prolific.

Snails and slugs that are garden pests in Oregon generally originated in Europe and Asia and were inadvertently imported to Oregon in nursery stock. They also wreck havoc on Oregon's agricultural crops (Savonen 1997). The banana slug is native to the Pacific Northwest.

Earthworms that occur in Oregon gardens were introduced from Europe. They often displace native species. 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 benefits or gains would not justify the cost. In other cases, techniques for controlling invasive species are not well-developed, or could cause more harm than good. For example, although bullfrogs can be killed by electro-shocking the water bodies in which they occur, the process will also kill native amphibians and fish.

The most obvious solution to the problems caused by invasive animals and plants is to stop introducing them deliberately. The Oregon Department of Fish and Wildlife has terminated its exotic game-bird propagation program, and adopted regulations to control the importation of exotic pets that could thrive if released in the wild. However, the agency still actively stocks populations of exotic lake trout, brown trout and brook trout. Policies limiting the introduction of exotic aquatic organisms are improving but they remain ambiguous. The 1997 Legislature directed the agency to study the effects of "predators," including exotic fish, on native organisms.

Oregon nurseries continue to sell English ivy and scotch broom, which are purchased by homeowners unaware of the problems they cause.

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.

Develop an early prevention and detection program, as the most practical, economical, and effective means of managing invasive exotics. This includes limiting the introduction of new exotics in 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.

Improve education and awareness. Train resource agency personnel. Develop outreach materials for the public. Offer recognition for special efforts to identify and control exotics. Incorporate information about exotic species into a variety of other efforts and programs.

Ensure that adequate baseline data are available on the distribution of exotics. Use cooperative approaches for mapping problem areas, and update regularly.

Include provisions for managing exotics in resource management plans.

Use an integrated approach to managing exotics and 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 controls 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).

Ensure that management plans are carried out efficiently and consistently across jurisdictional and political boundaries. Any effective approach must cross interagency boundaries and include the private sector. Actions include training, coordinated funding and cooperative research.

Ensure that sufficient data are available to implement and evaluate management actions. Develop and implement standardized monitoring techniques. Train a broad range of participants to recognize harmful plants, and develop a reporting system to support early detection and eradication efforts.

More research is needed to determine the most effective long-term strategies for controlling harmful exotic weeds.

Simply killing the weeds is not enough. More attention must be given to ecological considerations so that the outcome is the creation of 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:

Offer a cash reward for early detection of an invasive exotic plant or animal.

Offer bounty payments for delivery of desired exotic plants or animals.

Post “wanted posters” to increase public awareness about the problems. Show pictures of the culprits and maps of their distribution.

Organize volunteers to remove exotic plants from parks and natural areas. Ask hikers and campers to report exotic plants in back country areas.

Get scout groups involved by offering badges for helping to control exotic plants or cash rewards for enrolling homeowners in programs to control exotics.

Local governments could offer homeowners incentives to discourage planting of invasive plants, and encourage removal of problem plants. Begin with education and friendly requests. Then offer assistance from city crews, or offer to share the cost of removal. Adopt regulations to prohibit the planting of invasive exotics in sensitive areas.

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

Offer stewardship certification to nurseries that agree to provide information on invasive exotics and not to sell them, and that also stock native plants and promote their ecological benefits.

Use permissive angling and hunting regulations to encourage the harvest of exotic fish and wildlife species.

CONCLUSION

The decline of Oregon's 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 they no longer function as they should. Most of these actions are not willfully malicious. Generally, people damage the environment in the course of living their daily lives, often without understanding the implication of their actions, especially the cumulative effects of many small impacts over a long period.

The good news is that Oregon is in much better condition ecologically than many other places. Vast, open spaces are still abundant with wildlife and beautiful scenery is found throughout the state. 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 state officials and others concerning watershed restoration, and have contributed in many ways to efforts on



the ground. Oregonians have a strong interest in quality-of-life issues that include a healthy environment and outdoor recreation opportunities. But a great deal of work remains to be done to restore damaged ecosystems and to make sure the ones in good condition stay that way.

Conserving and restoring biodiversity implies changes in the way we live and do business. Some of the changes will be relatively painless and cause minimal disruption to 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 as a society we are 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 regulations are sometimes implemented in a manner that 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” and require 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 Oregon is to restore salmon populations, clean up contaminated waterways, 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 Oregon and elsewhere on the need for both a carrot and stick approach. Perhaps we should think twice about using the stick when the carrot could accomplish desired objectives and possibly at less cost.

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 adjustments can be made when systems fail to produce the desired results. Providing these additional conservation tools will help 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 leaving a legacy to future generations—a legacy that includes healthy wildlife populations, clean air and water, functioning ecosystems, vital 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 if they understand what changes need to be made. If our friends, relatives and business associates also recognize the importance and participate in conservation efforts, our chances of success will be even greater.

Good stewardship of our natural resources is everyone's responsibility, and given the right incentives, we can all work to make a difference in Oregon. The bottom line is that we, not they, are responsible for good stewardship. All of us, all the time.

APPENDIX A: SUMMARY OF CONSERVATION INCENTIVES

FINANCIAL INCENTIVES

INCENTIVES	PROBLEM ADDRESSED	MECHANICS	COST	EXAMPLES	COMMENTS	REFERENCE
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.	Keystone Center, 1995 OR Dept. of Forestry, 1996 Ferris, 1996
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			Keystone 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.		Keystone Center, 1995 McKinney et al. 1994 Ferris, 1996
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			Keystone Center, 1995 McKinney, 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			Keystone 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.	Keystone Center, 1995 Florida GFWFC, 1994
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 & maximize return on commercially valuable property.	Keystone Center, 1995
8. Provide financial incentives for riparian protection	Riparian lands have high ecological & commercial value.	Use OR state tax credit to cover management costs.			Statute recently updated in Oregon.	OR Dept. of Forestry, 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 Dept. of Forestry, 1996 Florida GFWFC, 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 Dept. of Forestry, 1996 Yager, 1994, Ferris, 1996

FINANCIAL INCENTIVES, *continued*

INCENTIVES	PROBLEM ADDRESSED	MECHANICS	COST	EXAMPLES	COMMENTS	REFERENCE
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.	Willamette River Basin Task Force, 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.	Willamette River Basin Task Force, 1997
13. Consolidate funding for federal, state assistance programs	Funding is hard to find and match with priority projects.	Consolidate programs & channel funds to priority habitat projects	Could be neutral.		Requires state, perhaps federal legislation	OR Dept. of Forestry, 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 erodible land, expanded to address wildlife habitat.	Federal legislation updated 1996.	OR Dept. of Forestry, 1996 Ferris, 1996
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.	Anderson, 1994
16. Lease in-stream water	Water rights unused diverted to other users, often wasted.	Individuals, groups purchase water & leave it in streams.	Nominal	Oregon Water Trust	Requires change in some state laws. Some states don't allow in-stream use for wildlife.	Anderson, 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 admin.	HCP process uses habitat quotas. Air pollution credits.	Complex bureaucratic structure to administer. Based on notion that certain habitat is "surplus." Controversial.	McKinney et al. 1994, Ferris, 1996 Florida GFWFC, 1994
18. Voluntary Land Enrollment Approach	Landowners lack financial incentives to protect habitat.	Landowners paid for certain land management 1. Lands identified 2. Management defined 3. Compensation identified from a variety of sources		Resembles conservation reserve and wetland reserve programs.		Bean, 1994
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 admin.	New Jersey Pinelands wetland banking	Requires precise land, habitat inventory & evaluation. Considers size and shape. Avoids parcel disputes. Legislation required to facilitate, process and address tax issues.	Yager, 1994

FINANCIAL INCENTIVES, *continued*

INCENTIVES	PROBLEM ADDRESSED	MECHANICS	COST	EXAMPLES	COMMENTS	REFERENCE
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'Toole, 1994, 1997 Ferris, 1996
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'Toole, 1996
22. In-kind materials	Landowners may not be able to afford materials for restoration, habitat improvement.	Agencies, organizations provide plants, construction materials.	Low	Provide tree seedlings or fencing materials.	Landowners or non-profits provide labor.	OR Dept. of Forestry, 1996
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. Johnson, 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. Johnson, 1995 Ferris, 1996
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 & specialty timber program.		K. Johnson, 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. Johnson, 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.	Keystone 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 Dept. of Forestry, 1996 Pacific Rivers Council, 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 when land set-aside.			May require change in federal tax law.	OR Dept. of Forestry, 1996

FINANCIAL INCENTIVES, *continued*

INCENTIVES	PROBLEM ADDRESSED	MECHANICS	COST	EXAMPLES	COMMENTS	REFERENCE
30. Increase timber liquidity to increase rotation	Difficult to turn standing timber into cash. Promotes early harvest	1. Timber futures market 2. Revolving loan fund 3. Create standard process for timber appraisal.	Some public funds needed.	Chicago Board of Trade to open futures market for recyclable materials.		K. Johnson, 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 Dept. of Forestry, 1996

HABITAT CONSERVATION PLANNING

INCENTIVES	PROBLEM 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 DoI 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 scale habitat recovery planning	Existing, single endangered species approach too narrow.	Focus planning on larger areas, multiple species before they get into trouble.		Coastal sage scrub.	May require amendments to ESA and FACA.	Opdycke, 1994
7. Issue interim incidental take permits	HCP process takes a long time.	Issue temporary incidental take permits while regional plans are developed.	Admin.		Requires amendment to the ESA.	Bartel, 1994
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

HABITAT CONSERVATION PLANNING, *continued*

INCENTIVES	PROBLEM ADDRESSED	MECHANICS	COST	EXAMPLES	COMMENTS	REFERENCE
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.	Involves 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.	Admin.		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
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 admin.	Forest Stewardship Incentive Programs	Existing programs underfunded.	Florida GFWFC, 1994

STREAMLINING REGULATIONS

INCENTIVES	PROBLEM ADDRESSED	MECHANICS	COST	EXAMPLES	COMMENTS	REFERENCE
1. Pre-listing conservation agreement	Landowners see endangered species as liabilities.	Voluntary actions to conserve species in return for regulatory relief for landowners.	Admin.		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

STREAMLINING REGULATIONS, *continued*

INCENTIVES	PROBLEM ADDRESSED	MECHANICS	COST	EXAMPLES	COMMENTS	REFERENCE
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.	Admin.		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.	Admin.		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, delist endangered species.	Permit management flexibility for threatened species .	Admin.		Congress make clearer distinction between threatened and endangered species	Keystone Center, 1995
6. Streamline regulatory process for Oregon 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		Requires change in OR admin. Rules.	OR Dept. of Forestry, 1996
7. Simplify regulations for certified good managers	Many regulations are complex and expensive relative to conservation benefits.			Stewardship agreements	Bill approved by 1997 OR legislature.	OR Dept. of Forestry, 1996
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.	Bill approved 1997 Oregon legislature.	OR Dept. of 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 admin.	Red cockaded woodpecker colonies in NC .	Will require intensive survey and monitoring- authority now exists.	Bean, 1994 Schaerer, 1996
10. ESA Section 7 blind trust fund	Delays in endangered species consultations cost land owners money.	Establish "blind" trust fund with private money to pay for timely consultations.	None to government		Changes in ESA & regs may be required.	Yager, 1994
11. Issue long-term management permits	Landowners need certainty.		Admin.	HCP	Permits 10-15 years in return for exemption from new regs.	K. Johnson, 1995
12. Different permits for sensitive sites	Permit requirements too stringent for sites of lesser value, too lax for important areas.	General permits, exemptions, less restrictive permits for low priority sites.	Admin.		Purpose is to focus regulatory effort on high priority areas.	Florida GFWFC, 1994

STREAMLINING REGULATIONS, *continued*

INCENTIVES	PROBLEM ADDRESSED	MECHANICS	COST	EXAMPLES	COMMENTS	REFERENCE
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
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. Johnson, 1995

REVENUE FOR INCENTIVE PROGRAMS

INCENTIVES	PROBLEM 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 affected impact fees for development.	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 programs.	Funding from public and private sources to purchase land, easements, contracts, management, administered by board.	Could be neutral if subsidies redirected.	Private conservation organization.	Funding from extractive uses and recreational user fees.	Schaerer, 1996 O'Toole, 1994

REVENUE FOR INCENTIVE PROGRAMS, *continued*

INCENTIVES	PROBLEM ADDRESSED	MECHANICS	COST	EXAMPLES	COMMENTS	REFERENCE
6. Recreational user fees on public and private lands	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	PROBLEM 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 land owners 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	ESA seen as punitive. Technical assistance more local, positive.	Information, dollars, materials and other assistance to landowners. Includes agency coordination. Voluntary toll-free number. Help capitalize on wildlife.	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 programs.	Keystone Center, 1995 Ferris, 1996
4. ESA 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 commissions	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

EXCHANGE AGREEMENTS

INCENTIVES	PROBLEM 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.	Admin. 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.	Admin. by public or private interests.	Aerojet General traded Florida ES land 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	PROBLEM ADDRESSED	MECHANICS	COST	EXAMPLES	COMMENTS	REFERENCE
1. Publicize innovative approaches	Landowners often don't get credit for improving or restoring habitat.	Encourage media to cover successful projects.	Admin.		Some landowners don't want recognition.	OR Dept. of Forestry, 1996 Ferris, 1996
2. Recognition / Award Program	ESA 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	PROBLEM ADDRESSED	MECHANICS	COST	EXAMPLES	COMMENTS	REFERENCE
1. Adopt one natural area's inventory system and support it	Conflicting data bases 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	PROBLEM ADDRESSED	MECHANICS	COST	EXAMPLES	COMMENTS	REFERENCE
1. Educational assistance	Landowners may not be aware of habitat management techniques & regulatory options.	State, federal agencies, private organizations.	Moderate	NRCS, ODOF, USFWS, ODFW, 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.	Admin.	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 admin.	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	UW Landscape Management System under development.	Must be practical for all users.	K. Johnson, 1995

APPENDIX B: PROJECT COMMITTEE MEMBERS, KEY CONSULTANTS, AND STAFF

STEERING COMMITTEE

Dan Heagerty (chair), director, natural resources and environmental services, David Evans and Associates, an environmental engineering firm in Portland, Oregon.

Terry Flores, hydro policy administrator for PacifiCorp, in Portland, Oregon.

Thomas Imeson, vice president for government affairs for PacifiCorp, the parent corporation of several of the region's largest investor-owned utilities, in Portland, Oregon.

Catherine Macdonald, director of stewardship for the Oregon Field Office of The Nature Conservancy in Portland, Oregon.

Fred Otley, president of the Oregon Cattlemen's Association and owner of a large family cattle ranch in Diamond, Oregon.

Howard Sohn, a timberland owner and president of Sun Studs, Inc., a wood products manufacturing firm in Roseburg, Oregon.

Sara Vickerman, director of the West Coast office of Defenders of Wildlife and project director of the Oregon Biodiversity Project in Lake Oswego, Oregon.

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PROJECT SUPPORTERS

Georgia-Pacific Corporation	Sequoia Foundation
Laird Norton Endowment Foundation	Starker Forests, Inc.
Meyer Memorial Trust	Sun Studs, Inc.
National Gap Analysis Program	U.S. Department of Defense / Legacy Program
National Fish & Wildlife Foundation	U.S. Environmental Protection Agency
The Nature Conservancy, Oregon Chapter	U.S. Fish and Wildlife Service
Oregon Department of Fish and Wildlife	Weeden Foundation
PacifiCorp	Weyerhaeuser Company Foundation