Restoration of Federal Forests in the Pacific Northwest: Strategies and Management Implications

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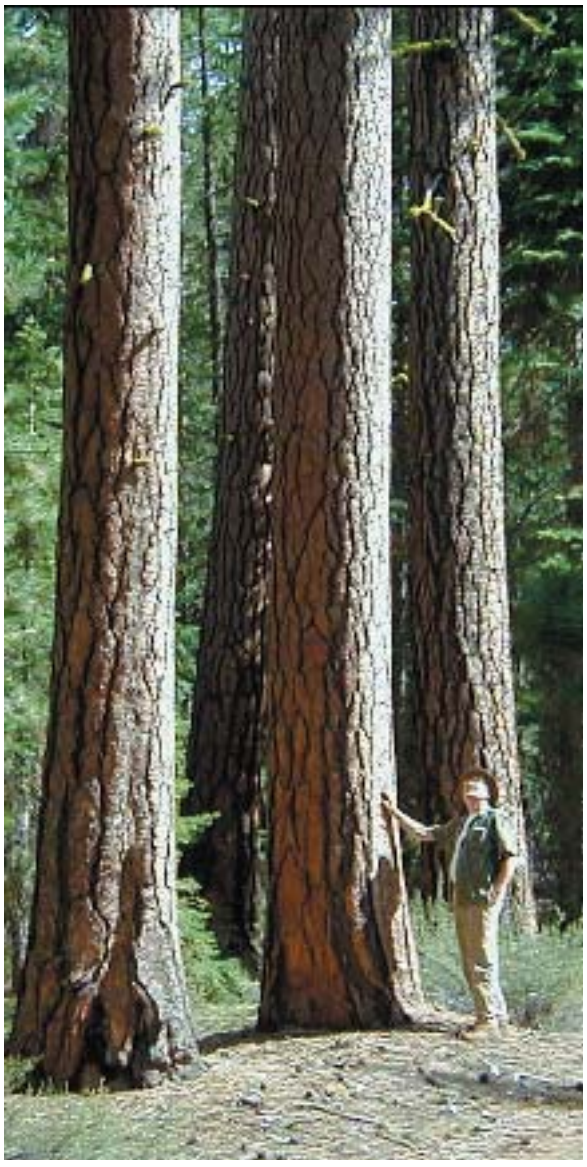

Preface[1]

We conducted this analysis believing that it is important to develop and implement an active management program on federal lands in the Pacific Northwest in order to restore ecological values, and contribute to sustainable local communities. We believe that there is broad societal support for such a program. However, continuing struggles over disposition of the remaining old-growth forests and future use of roadless areas have been major impediments, distracting key stakeholders. New policies are needed that:

- focus on ecological restoration of federal forests;
- conserve old-growth forests and trees;
- retain roadless areas and
- support local communities and work forces

Lack of trust between stakeholders and resource management agencies is an additional impediment to implementing an active restoration strategy. Many stakeholders do not trust foresters in federal agencies to develop and administer programs directed toward ecological restoration and stewardship. To help rebuild such trust, clearly defined goals and boundary conditions, such as which trees and forests will be retained and which can be removed, are needed; trust ultimately will be re-established with verification that these goals and limitations have been fulfilled.

In this paper we focus on conservation of old-growth forests in the context of a general restoration strategy for federal forests of the Pacific Northwest. Toward that end, we suggest and evaluate the potential for utilizing age thresholds as a beginning point in conserving old growth forests and trees while exploring management strategies that will be needed to sustain federal forests into the future in the face of environmental change.

Forest restoration has many facets. Here we concentrate on the conifer forests of the Northwest, while recognizing the inter-connection of forest and watershed restoration and the importance of functioning riparian and aquatic systems. Further, we acknowledge that there are tensions among the different elements of a comprehensive restoration program on the federal forest estate.

We have written this paper to catalyze further discussion and evaluation of policy alternatives. In the last decade federal agencies have largely ceased harvesting mature and old-growth forests in response to changing policies and public pressure. Yet, arguments over management of these forests continue to bedevil restoration efforts. It is time to consider taking the next step and formally developing policies to conserve old-growth forests and the old-growth trees within them. These policies, however, need to be developed in a broader framework of overall forest sustainability that considers historical disturbance processes, the effect of environmental changes, and goals for these lands.

The paper was initiated as part of discussions with the staffs of Senator Ron Wyden and Congressman Peter DeFazio about how to craft policies to conserve old growth forests. However, we found we could only discuss old-growth conservation in the context of broader restoration strategies for federal forests. Thus, the paper grew into the more general discussion of forest restoration presented here.

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[1] *An earlier version of this report was reviewed by Derek Churchill, Miles Hemstron, Paul Hessburg, James Johnston, Dave Perry, Tom Spies, and John Tappeiner. We also were assisted by resource analysts in the Forest Service Region 6 and the Oregon Office of the Bureau of Land Management. We believe that it is a much better report as a result. Any remaining errors or lapses in judgment are entirely our responsibility. This study was completed without any special financial support.*

Summary

In this paper, we suggest a forest restoration strategy for the national forests of Oregon and Washington and the forests managed by the BLM in western Oregon. In addition, we analyze some of the management and timber harvest implications of that strategy.

A major initiative is needed to restore our federal forests, engage and sustain communities, and prepare the forests for climate change.

This restoration strategy focuses on improving 1) the ecological, economic, and cultural contributions of federal forests in the Pacific Northwest and 2) the sustainability of these forests in the face of environmental change. Key goals include making Pacific Northwest forests more resistant and resilient to wildfire and insects; conserving old-growth forests and trees; and creating an immediate and predictable timber flow to support locally-based restoration economies.

We attempt to respond to these goals by focusing on forest restoration activities that achieve ecological goals while simultaneously providing economic and social benefits. We feel that these types of actions are most likely to have public support and, consequently, be rapidly implemented.

In this analysis we develop a relatively simple framework for federal forest management that provides both management direction and some general limitations on those activities. Ideally, this framework would be used in combination with increased agency discretion in interpretation and implementation of the actions needed—*i.e., it would simultaneously both limit agency discretion and protect it*.

Recognizing Moist and Dry Forests

Sustainable forest policies need to recognize historical disturbance processes along with alterations in these processes that are likely to occur with climate change. Thus, we attempt to balance the wisdom of history with probable future changes. Toward that end, we divide federal forests in the Pacific Northwest into Moist and Dry Forests reflecting their composition, growth conditions, and historic disturbance regimes, while recognizing that these represent contrasting ends of a disturbance continuum.

We use plant associations as the basis for grouping federal forests into Moist and Dry Forests. Plant association classifications are based on the systematic study of plant composition and other attributes of forest ecosystems, site attributes including productivity, management potential, and the characteristic fire regime. Of course, landscape context is also an important determinant of fire regime even for areas representing the same plant association, so characterizations of fire regimes for plant associations reflect central tendencies and not absolutes**.** While plant communities will change as climate changes, they will continue to be valuable ecological reference points for conservation and management.

Moist Forests belong to plant associations that were historically characterized by infrequent high-severity, stand-replacement disturbance regimes, although mixed and low-severity disturbances also occurred, often as a part of a large disturbance event.

Continuing conflict over old growth and roadless areas has consumed stakeholder and agency attention for decades; resolution is needed so we can move ahead.

Moist Forest ecosystems have evolved with severe, stand-replacement disturbance events, whether from wildfire, windstorm, or volcanoes. The composition

Policies must recognize and accommodate the immense variability that exists in forest ecosystems, starting with the differeneces between "Moist Forests" and "Dry Forests."

and structure of intact existing old-growth forests in Moist Forests *have not been* significantly affected by human activities, as is the case in the Dry Forests. Generally, it *will not be necessary* to conduct silvicultural treatments to maintain existing old-growth forests on Moist Forest sites. Silviculture can, however, be used to create diverse early seral communities and accelerate development of ecological diversity in plantations. We suggest general silvicultural strategies for restoration activities in these young Moist Forests.

Dry Forests belong to plant associations that were historically subject to low- and mixed-severity disturbance regimes, with these lower severity events occurring as more frequent fire. In recognition of the potential for longer fire seasons and more frequent and severe wildfires with climate change, for purposes of policy development, we generally group plant associations typically subject to mixed-severity disturbance regimes with the low-severity forests; this also reflects probable shifts toward more frequent fire regimes with climate change.

Dry Forest ecosystems have evolved primarily with low- and mixed-severity disturbances, predominantly wildfire. Here, the composition and structure of intact existing old-growth forests *often have been significantly affected by human activities*, resulting in increases in stand density and compositional shifts to tree species that are less fire- and drought-resistant. In ecological restoration, silvicultural treatments, including timber harvest, need to focus on conserving remaining old trees, restoring more sustainable forest conditions (e.g. modifying fuel loadings), and reducing stand densities across the landscape. The specifics of these treatments are a function of plant association and landscape context.

Identifying Federal Forests where Timber Harvest Might Occur

We identify land allocations on which silvicultural activities, including timber harvest, appear to be an acceptable tool for achieving restoration goals. We begin with approximately 25 million acres (22 million forested acres) on the national forests and 2.5 million acres (2.3 million forested) administered by BLM in western Oregon. On the national forests, we then remove Wilderness, Inventoried Roadless Areas, and areas withdrawn from timber harvest in the national forest plans from consideration; on BLM lands, we remove land categories withdrawn from timber harvest. We do not include Inventoried Roadless Areas because timber harvest on these areas is questionable even though final decisions on the allocation of these lands have not been made. We also recognize additional existing policy direction that provides the foundation of a regional forest conservation strategy--the Northwest Forest Plan (NWFP). Within the area of the NWFP, we start with the land allocations and direction in that plan, including Late Successional Reserves (LSRs) and the Aquatic Conservation Strategy. Outside the area of the NWFP, we recognize the applicable aquatic conservation strategy such as PACFISH and INFISH.

Utilizing Ecological Forestry to Guide Actions

We base our silvicultural proposals on an approach known as "ecological forestry." Ecological forestry utilizes principles of natural forest stand development, including the role of natural disturbances in the initiation, development, and maintenance of forest stands and landscapes and operating on temporal scales consistent with recovery of desired structures and processes. Ecological forestry activities are typically planned at the landscape and stand scales, incorporate knowledge developed from the study of pattern and ecological function in natural land-

The principles of natural stand development can provide a guide to action.

To conserve "old growth", we need to focus on old stands in Moist Forests and old trees in Dry Forests.

scapes, and consider landscape components having special ecological significance, such as aquatic features and early-successional and other non-forested communities within forest landscapes. In both Dry and Moist Forest stands, there is a goal of restoring spatial heterogeneity--a non-uniform distribution of forest structural elements, such as trees, snags, and canopy density—when appropriate. Such heterogeneity is characteristic of older forest stands and landscapes on both Moist and Dry Forest sites.

Conserving Older Stands and Trees

In Moist Forests, we focus on *conservation of older stands.* We examine consequences of using three different ages to define "older stands:" 80 years, 120 years and 160 years, three age thresholds that have often been proposed and discussed. This range goes from including essentially all of the mature and old growth forests (at threshold age 80 years) to including most mature and all old growth forest (at threshold age 120) to including the most structurally advanced mature and all of the old growth forest (at threshold age 160 years). We also assume that any age threshold applies to older trees (greater than 80, 120, or 160 years of age) that occurred as individuals or small clusters within younger stands. Anxiety over exactly where to draw the boundaries of older stands should be reduced by including scattered trees that meet the age threshold in the conservation strategy.

In Dry Forests, we focus on *conservation of older trees*, with those trees defined as being at least 150 years of age. We recognize that old growth stands can be found in Dry Forests, but conserving the older trees within them typically requires active management within these stands. This age was chosen because: 1) trees in Dry Forests begin to exhibit some characteristics of old growth at these ages and 2) fire exclusion--through suppression of natural wildfires, fires set by Native Americans, and introduction of domestic livestock into these forests--began about 150 years ago.

We utilize age—of stands and of trees--as one of the defining limits on management activities for several reasons:

- Society is interested in conserving older forests and trees.
- Past activities have reduced their occurrence to levels far below historical levels.
- Alternative approaches (e.g. diameter limits) fail to identify and protect many older trees. Many old ponderosa pine and western larch are less than 21 inches diameter breast height (dbh), a common current diameter limit. As importantly, diameter limits can deter the harvest of young, relatively large trees that crowd older trees, greatly increasing the risk that the old trees will die as a result of either wildfire or insect attack.
- Utilizing a more general or less precise definition of old growth has the potential for creating endless debate and delay. Simple rules, on the other hand, have facilitated recent management of Moist and Dry federal forests.

Is an age-based limitation practical? Some question whether an age-based approach can be implemented suggesting that foresters will have to bore every tree in a timber sale to establish its age. We believe that few trees will actually need to be bored based on the process suggested here. First, foresters have aged trees and stands for generations and continue to do so today. Second, most existing stands

No single age defines "old growth", but age thresholds are useful in old growth conservation and restoration.

Clearly defined boundaries–such as those provided by land allocations, diameter and age limits–have proven effective in recent federal forest management.

in Moist Forests are clearly either above or below the age limits; the vast majority of young stands resulted from clearcutting in which older trees were not left. The question of the age of individual trees does arise in some young natural stands in Moist Forests, and in the Dry Forests where old trees are often intermingled with young trees. For this situation, we suggest a process in which the agencies develop and implement aging protocols utilizing field studies, and then gather information in timber sale layout and post-sale monitoring activities to improve the protocols over time, all with periodic reviews by scientists, stakeholders, and forest managers.

Dry Forest Restoration Strategies

The majority of existing Dry Forests on federal lands still retain some older trees (defined in Dry Forests as trees over 150 years of age) even though these forests have been drastically modified by human activities. Historically, many of these stands had relatively low tree densities that were dominated by 10 to 20 large older trees of fire- and drought-resistant species, such as ponderosa pine and western larch, and displayed much spatial heterogeneity, consisting of fine-scale, low-contrast structural patchworks. Denser, even-structured stands also existed with up to 50 dominant trees and Douglas-fir, western larch, and ponderosa pine as common species; such forests dominated some landscapes as a result of more severe fires and insect epidemics.

Today most stands and landscapes of both types have been dramatically modified by such activities as grazing by domestic livestock, timber harvest, tree planting, and fire suppression. Both mechanical treatments and prescribed fire can be useful in restoring these forests; we propose that detailed prescriptions should be keyed to plant associations and the landscape context.

Key elements of a restoration strategy for Dry Forest sites are:

- Protect and conserve all older trees (trees greater than 150 years of age), including reducing fire-and competitive risks to these trees;
- Reduce basal areas in overstocked stands;
- Increase the mean diameter of stands;
- Shift composition toward more fire- and drought-tolerant species, such as ponderosa pine and western larch, and away from less fire- and drought-tolerant species, such as white and grand fir;
- Restore characteristic levels of within-stand spatial heterogeneity;
- Manage small and intermediate tree populations to restore and maintain characteristic population levels of old and large trees;
- Restore characteristic levels of ground fuels and understory vegetation, using prescribed fire where possible;
- Encourage hardwood tree and shrub recovery in riparian habitats;
- Retain patches of dense forest scattered across the landscape within the area of the NWFP to help conserve the Northern Spotted Owl and its prey species; and
- Plan and implement restoration activities at larger landscape levels, encompassing the variety of restoration efforts that are needed within a landscape and ensuring that spatial complexity is incorporated at larger spatial scales.

Rapid movement through the Dry Forests, using both mechanical treatments and prescribed fire, is necessary to address threats from wildfire, drought, and insects; coming climate change creates even greater urgency.

Unlike conservation approaches for older stands in Moist Forest sites, mechanical treatments will

Creating fuel breaks will not save Dry Forests and the old growth trees within them.

be needed within many Dry Forest sites where older trees are present. These actions will help sustain and restore these older tree populations in the face of enhanced current threats from fire and insects, the latter the result of increased competition in the unnaturally dense stands

Given the high potential for catastrophic loss of resource values in the Dry Forests on federal lands, we believe that ecological restoration should be comprehensively implemented across the federal forests over the next 20 years.

With this strategy, we call for restorative treatments that cover up to two-thirds of the landscape. This extensive effort is needed to provide for:

- Restoration of ecologically desirable conditions on the majority of the landscape—including retention of existing and restoration of historic old-tree populations;
- Reduced potential for large, severe wildfires and insect outbreaks, even under conditions of climatic change;
- Increased resiliency – i.e., ability of disturbed forest landscapes to recover when severe disturbances do occur; and
- Restoration of spatial heterogeneity from the scale of small patches to large landscapes.

A recent analysis of conservation strategies for the Northern Spotted Owl in Dry Forests has come to a similar conclusion, i.e.,--treat up to two-thirds of the landscape over time; recent landscape simulations of fuel treatments suggest treating 40-65% of the landscape. Both spotted owl conservation and fuel reduction should be considered within the broader goal of ecological restoration.

We urge that any guidance, regulation, or legislation for Dry Forests be permissive, i.e., they would permit actions but not require them, allowing land management agencies discretion in implementation. However, this discretion must be paired with periodic independent review of whether the actions being taken are achieving stated goals.

Moist Forest Restoration Strategies

Moist Forests were characteristically subject to stand-replacement disturbances at intervals of one to several hundred years and required centuries following a stand-replacement disturbance to develop the massiveness and structural complexity characteristic of old-growth forests. Key elements of a restoration strategy for these forests include:

- Reserving *existing* older forests using a threshold reservation age of 80, 120, or 160 years;
- Accelerating the development of complexity in young forest stands, particularly those originating as plantations, through a variety of silvicultural activities, including variable-density thinning. Extending the maximum age of stands eligible for thinning in Late Successional Reserves from 80 years (current policy) to 120 years would aid in this effort;
- Implementing regeneration harvests in Matrix forests using principles of ecological forestry to help provide a regular flow of structurally-complex, early successional habitat (as well as other early stages of forest development). These actions could help provide ecologically important habitats that have become increasingly rare while also supplementing timber harvests; and
- Planning at the landscape scale so as to incorporate knowledge developed from the study of pattern and ecological function in natural landscapes.

Restoration of sustainable and diverse ecological conditions can serve as a primary goal in managing the Drry Forests.

Thinning Moist Forests can accelerate development of complexity and improve reslience in the face of climate change.

Restoration of Moist Forests is not intended to alter their historical wildfire behavior. Rather it is intended to accelerate the development of older complex forest and provide a modest amount of diverse early successional communities and timber harvest. While the decision of how much fire suppression to attempt in these forests is certainly a social issue, stand–replacement fires have historically provided ecological benefits. In addition to creating structurally complex early-successional communities, these fires help revitalize streams and wet meadows with wood and sediments.

General Implications of These Restoration Strategies

The forest restoration strategies described above will:

- Accelerate the restoration process for federal forests of the Pacific Northwest by;
    - * Increasing the percentage of the Dry Forest treated per year on the national forests and BLM lands
    - * Addressing the enormous federal plantation acreage over the next 20 years that will achieve initial thinning age of 30-60;
- Protect existing older stands and trees; and
- Assist in the development of structurally-complex late-successional forests (in Late Successional Reserves and Riparian Reserves) and diverse early successional communities (in the Matrix) on Moist Forests; and restore more sustainable and ecologically functional forests and landscapes in the Dry Forests.

The forest restoration strategies will provide timber products and income over the next 15-20 years that will:

- Help pay for needed actions;
- Increase harvest levels on federal forests;
- Make available significant quantities of biomass; and
- Provide employment and community engagement in the restoration process, thereby maintaining a skilled workforce and processing capabilities.

Investments will be required in rebuilding and improving forest roads and in planning and implementing silvicultural treatments.

Timber Harvest Implications of Restoration Strategies

The strategies suggested here generally follow the land allocations and standards in the Northwest Forest Plan and existing aquatic conservation direction in areas outside the scope of the Northwest Forest Plan. In addition, they reserve older forests and older trees, and assume that Inventoried Roadless Areas will *not* be entered. In that context, we estimated timber harvest levels that could result from application of the following restoration strategies:

Dry Forests

- On the national forests and BLM lands, commercial timber harvests are conducted on about ½ percent of the Dry Forest landscape per year, along with significant prescribed burning and shrub removal. Accelerating the rate of commercial harvest, at least doubling it as recommended here, should enable an increase in harvest volume from these forests over the next few decades.

Regeneration harvest of Moist Forests using principles of ecological forestry can help perpetuate biological diversity by providing scarce habitats.

Moist Forests

In recent years, federal agencies have concentrated almost exclusively on restoration thinning–very little old growth has been cut.

- Thinnings from stands less than 80 years of age currently provide almost all harvest volume. Harvest volume from thinning should increase over the next 20 years as large acreages of plantations reach a size and age suitable for commercial thinning.

- Instituting a Matrix regeneration harvest program in the next 20 years, using the principles of ecological forestry. These actions, in the short run, depend on being able to harvest stands between 80 and 120 years of age. Regeneration harvests in the Matrix are a major component of the long-run sustainable harvest level.

- Total potential timber harvest from federal forest lands is not strongly affected by whether the threshold age for reserving existing older Moist Forests is 120 or 160 years. Potential harvest is significantly lower, though, under a threshold age of 80 years.

Comparison to current harvest levels and future plans

- Recent timber harvest from federal forests (Forest Service and BLM) approached 600 million board feet per year, a significant increase from 2000.

- Accelerating restoration thinning and instituting a Matrix regeneration harvest program could raise the harvest to 1 billion board feet per year or higher for the next few decades.

- Harvest levels are difficult to estimate beyond the first 20 years, since they depend on many factors that may change through time. It is likely, however, that long-term sustained yields would be lower. In Moist Forests, longer-run sustained yield would be less than short-run volumes as restoration thinning is completed in reserves. In Dry Forests, a need for stand density treatments will continue although the level and methods of those treatments is uncertain.

- Growth in timber volumes would greatly exceed harvest even at a harvest level of one billion board feet per year.

Carbon Storage Effects

The restoration approach suggested here will have differing effects on carbon stocks in Moist and Dry Forests.

- In Moist Forests, growth will go largely toward rebuilding the carbon stocks that have been greatly depleted during the last 100 years of western settlement and use.

- In Dry Forests, density reduction will reduce overall carbon stocks initially with eventual recovery as the forest structure shifts to larger, older trees. Restoration also can reduce future carbon emissions by limiting the extent and severity of future wildfires, but at the cost of short-term emmisions associated with treatments. In addition, utilization of biomass created during logging can reduce these short-term emissions. In sum, the net effect of restoration of Dry Forests on the overall carbon balance remains unsettled.

Accelerating ecological restoration of both Moist and Dry Forests can also increase timber harvests for the next few decades and help prepare forests for climate change.

It can be argued that allowing forests to grow without intervention will result in the highest amount

Federal forests can serve as significant carbon sinks, but a sole focus on "climate reserves" will not restore these forests.

of carbon storage in the short-run. Such an approach, though, would be short-sighted and leave the forests and the old-growth trees within them vulnerable to coming climate change. A strategy that increases structural diversity and resilience in the face of disturbance, as suggested here, is more likely to achieve conservation goals.

Restoration Strategies in the Face of Climate Change

We have incorporated current expectations regarding climate change in a number of ways including:

- Rapid movement through the Dry Forests to address the threats to these forests from wildfire and insects, since these threats will probably develop very quickly as the result of climate change; and

- Grouping of most mixed-severity forests with low-severity (frequent fire) forests as candidates for active management, since we anticipate that those forests will shift to more frequent and severe fire regimes with climate change.

With climate change, systematic re-assessment of the proposed restoration strategy will be needed at regular intervals to assess its appropriateness.

Post-Disturbance Strategies

Wildfire and other natural disturbances, such as windstorms and insect epidemics, are an inevitable part of the future of both Moist and Dry federal forests. Some will be high-severity, stand-replacement disturbances, some will be mixed severity, and some low severity but such disturbances will still occur and challenge society's capability to cope.

What should be done after major disturbances? Should salvage occur? If so, which trees should be removed? What other activities should be undertaken? We respond to these questions based on the focus of this paper--strategies to restore federal forests and the benefits that flow from them. Our approach is relatively simple: *we develop guidance for activities on Moist and Dry Forest sites <u>after a disturbance</u> based upon their management direction <u>before the disturbance.</u>*

Restoration Strategy Challenges

There are several challenges in implementing this restoration strategy discussed in this paper.

- The Dry Forest strategy is an integrated approach that reduces the contrast in landscapes within reserves (LSRs) and Matrix in the NWFP area. Conserving the Northern Spotted Owl in Dry Forest landscapes will take innovative planning and implementation. Current policy uncertainty about approaches to Northern Spotted Owl conservation in Dry Forests could slow restoration efforts.

- Restoring forests while simultaneously conserving and restoring the watersheds within which they are located will create both opportunities and tensions. The strategy outlined here will re-

Rehabilitating a deteriorating road system while reducing impact on aquatic resources will provide a key restoration challenge.

quire maintenance, use, and repair of parts of a deteriorating federal road system. This creates both problems and opportunities for reducing the impact of roads on aquatic resources. Also the positive role that disturbance can play in revitalizing fish habitats needs consideration in large-scale strategies.

- Restoring federal forests will not be complete without recovery of riparian and upland hardwoods. Reintroduction of fire, conifer removal, and control of ungulates will all be needed.

- The social acceptability of regeneration harvests in the Moist Forest Matrix lands, using the principles of ecological forestry, will be a point of controversy.

- Finding ways to utilize the biomass (slash and small trees) left after harvest, rather than burning it, is an important issue. Capturing these short-term sources of climate-change gases for energy production would be beneficial to carbon balances.

- Successfully implementing these strategies will require professional management of the highest level. To do this, society will need to reverse the continued shrinkage of our federal land management agencies and restore them to a critical mass of field-oriented resource professionals.

- Substantial investment will be needed. While timber harvest receipts can help defray costs, they will not be sufficient to cover all the actions needed and the associated infrastructure and planning.

Significant investment will be needed to restore the federal forests of the Pacific Northwest.