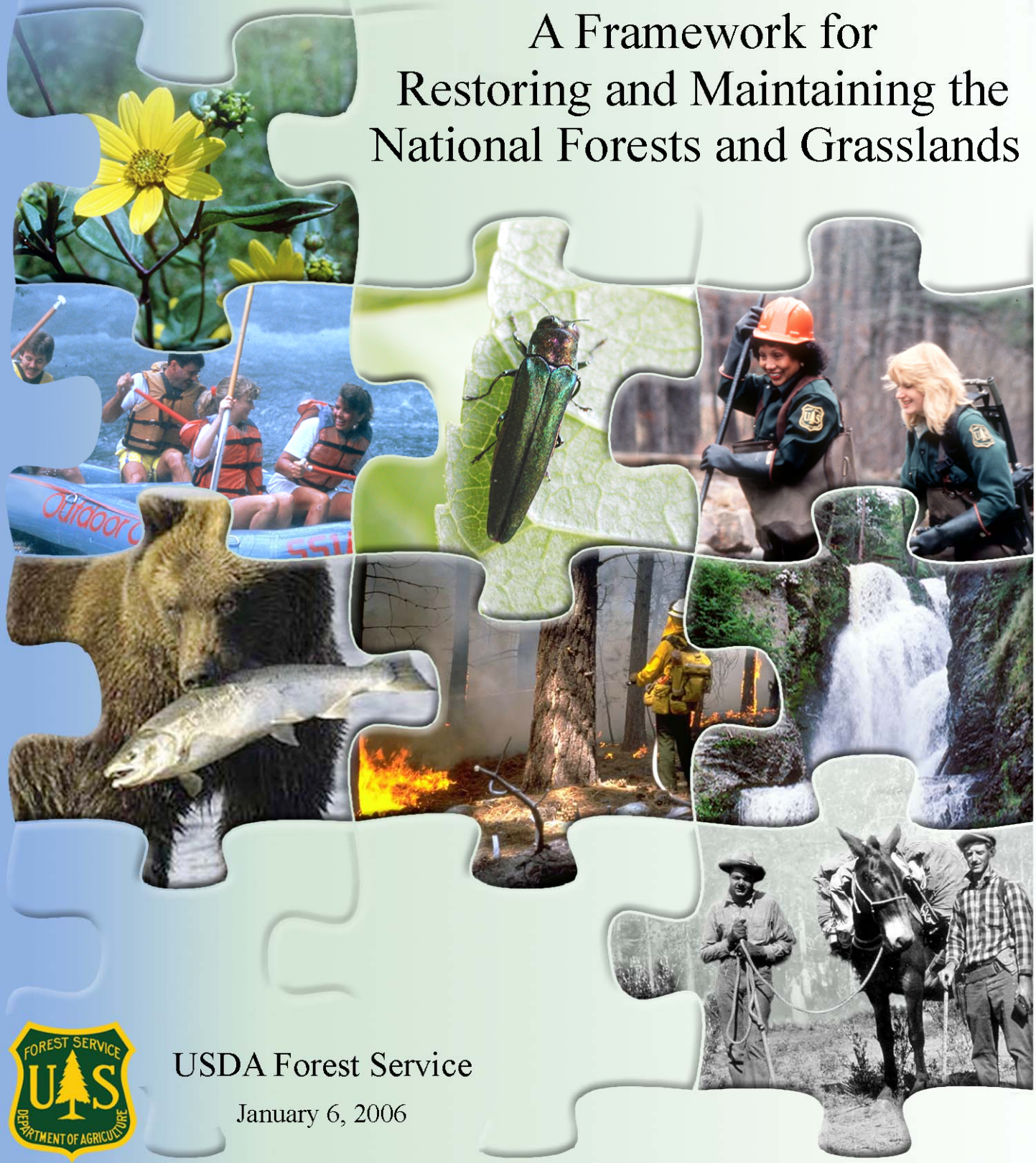
Ecosystem Restoration:

A Framework for Restoring and Maintaining the National Forests and Grasslands



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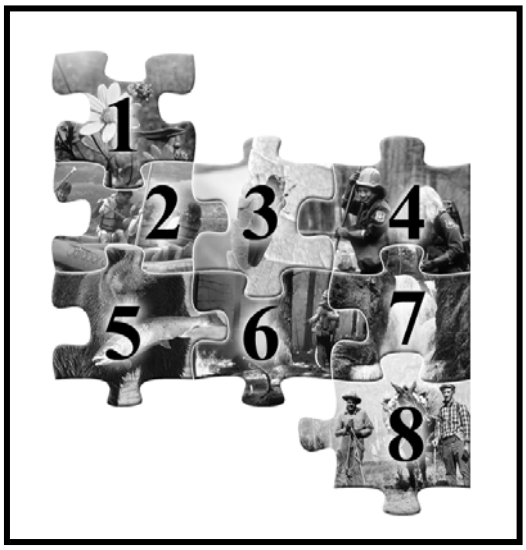

1. Eggert's sunflower (*Helianthus eggertii*)- A threatened species known to occur only in Kentucky, Tennessee, and Alabama.

2. Rafting on the Nantahala NF, North Carolina- People use the National Forests, and peoples' values determine the desired conditions for NF lands.

3. The Emerald Ash Borer (*Agrilus planipennis*)- A wood boring beetle (*Buprestidae*) that attacks ash (*Fraxinus*), usually killing trees in one-three years. Its introduction in 2002 has resulted in ash mortality in Michigan, Ohio, Ontario, Indiana and Maryland.

4. Fish researchers in the Ouachita NF, Arkansas- Researchers examining the relationship between water velocities and shear force, which occurs when two different water velocities collide. Depending on the shear's intensity, a fish may become disoriented momentarily, lose its scales, or be bruised or cut.

5. Grizzly bears and salmon in Ketchikan Alaska - Pacific salmon are keystone species, which means they are essential components of their ecosystem. Their absence would result in devastating effects to other plants and wildlife species, just as the removal of a keystone from a masonry arch results in its collapse. Therefore, the impacts of the current decline of salmon on the ecology of Alaska and the Pacific Northwest are staggering. As fewer fish return each year to spawn, there is less food for the animals that depend on them. More than 22 different animals feed on salmon throughout the fish's life cycle. Such animals include grizzly bears, orcas and various insects. Native people are also dependant on salmon as a traditional and substance food.

6. Prescribed fire in the intermountain west- Without periodic fire to reduce fuel load, forests become less fire-tolerant and the species composition changes.

7. Dingman's Falls, Pennsylvania – A sight-seeing attraction experiencing significant hemlock decline, causal agent: hemlock woolly adelgid (HWA).

8. Part of a crew on extensive reconnaissance about to set out for a side camp in the backcountry, 1924.

Back Cover: Biosphere- The biosphere is that part of a planet's outer shell—including air, land, and water—within which life occurs, and which biotic processes in turn alter or transform. It is the global ecological system integrating all living beings and their relationships, including their interaction with the elements of the lithosphere, hydrosphere, and atmosphere. This biosphere is generally thought to have evolved at least some 3.5 billion years ago.

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Executive Summary

The Executive Integration Team (EIT) chartered a Restoration Framework Team to develop "a strategic, integrated, science-based framework for restoring and maintaining forest and grassland ecological condition." Under its charter, the Team presents this Restoration Framework for consideration by the EIT and National Leadership Team.

The nation's forests and grasslands face serious threats to their long-term health, productivity, and diversity. Foremost are non-native invasive species, altered disturbance regimes, and climate change. These diverse threats affect aquatic and terrestrial ecosystems in virtually every region of the country.

Agency and public concern about some of these threats has led to the National Fire Plan, Healthy Forests Initiative, Healthy Forests Restoration Act, Invasive Species Strategy, and various administrative actions to help facilitate restoration actions. Nevertheless, the magnitude of ecosystem restoration needs greatly exceeds the organizational and financial capacity of the agency. Many forest and grassland ecosystems continue to degrade at a preventable rate. The agency must improve its productivity and effectiveness to achieve restoration objectives. New approaches are needed to clarify and focus the agency's policy for ecosystem restoration.

This Framework offers recommendations to improve the agency's ability to restore ecosystems. These recommendations address:

- adopting a national policy regarding ecosystem restoration, including defining ecosystem restoration as "the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed;"
- increasing the productivity of the agency's restoration efforts through improved integration of various programs spanning all Deputy areas;
- effectively applying national, forest, and project planning to engage Forest Service resources, partners, and stakeholders in identifying and implementing restoration needs and priorities; and
- using budget and performance incentives to increase accomplishment of ecosystem restoration objectives.

Protection of resources and restoration of severely degraded areas were the primary reasons for creating the Forest Service and establishing the national forests and grasslands. We believe that implementing the recommendations in this Framework will greatly strengthen the agency's ability to fulfill its mission of sustaining "the health, productivity, and diversity of the nation's forests and grasslands to meet the needs of present and future generations."

Background

Protection of resources and restoration of degraded areas were the primary reasons for creating the Forest Service and establishing the national forests and grasslands. The Organic Act, Weeks Act, Multiple Use–Sustained Yield Act, National Forest Management Act, and other statutes governing the management of the national forests and grasslands reinforce these fundamental purposes. Over the last century, the Forest Service has been quite successful in achieving these purposes while simultaneously striving to meet public demands for various uses of the National Forest System.

Despite past successes, challenges persist. Over the last decade, awareness of forest health problems facing the nation's forests and grasslands has grown. The increasing extent and frequency of uncharacteristically severe wildland fires and insect and disease outbreaks have been of particular concern to the public, the Administration, Congress, and land management agencies. These concerns led to the National Fire Plan, the Healthy Forests Initiative, and the Healthy Forests Restoration Act of 2003. The Forest Service has also focused attention on additional threats from invasive species, loss of open space, and unmanaged outdoor recreation. The need to meet all these threats has reinforced the Forest Service's dedication to restoration, inspiring many restoration projects.

The Forest Service's national strategic plan echoes these themes. As stated in the 2004 Strategic Plan, the agency's mission is "to sustain the health, diversity, and productivity of the nation's forests and grasslands to meet the needs of present and future generations." Three of the agency's six strategic goals address distinct restoration needs: reducing the risk from catastrophic wildland fire, reducing the impacts from invasive species, and improving watershed conditions.

Active management intervention is often needed to reach these goals. However, the magnitude of the management effort needed greatly exceeds the Forest Service's organizational and financial capacity. On many parts of the National Forest System, ecological conditions and trends—combined with recent and projected climate trends—pose serious threats to the long-term health, productivity, and diversity of forest and grassland ecosystems. A few prominent examples suffice to illustrate the threats:

- In the Great Basin, pinyon–juniper communities are replacing sagebrush-dominated plant communities as a result of fire suppression and overgrazing.
- In the East, oak-dominated systems are widely converting to maple, beech, and other shade-tolerant species due to alterations in natural and human disturbance regimes, a trend exacerbated by severe gypsy moth infestations.
- Native fish populations are declining and fragmenting due to man-made barriers to movement, altered flow regimes, and competition from non-native fishes.
- Watersheds, riparian areas, and aquatic communities are degrading due to past management activities, fragmentation, overgrazing, and the impacts of non-native invasive species such as purple loosestrife, salt-cedar, and zebra mussel.
- Non-native invasive species such as emerald ash borer, hemlock woolly adelgid, white pine blister rust, and sudden oak death are causing widespread forest damage.

- Remnants of tallgrass prairie are suffering damage due to fire suppression and invasion by exotic species such as leafy spurge, Russian olive, and Kentucky bluegrass.
- In southern California, chaparral and coastal scrub communities are converting to weedy grassland due to extremely high numbers of human-caused fires.

Need for a National Strategy

A broad consensus is emerging that ecosystem restoration is an overarching and unifying policy objective for various agency programs. Ranger districts and supervisor's offices are leading agency efforts at integrated, landscape-scale approaches to addressing restoration needs, applying the authorities and resources of multiple programs to achieve multiple benefits. By better aligning national policies and procedures with efforts in the field, the agency can help field units get more restoration work done on the ground.

Obstacles to restoration are widespread. For example, the 2004 National Integrated Fuels and Restoration Review reported the following key findings:

- Differing interpretations of restoration have led to confusion over agency objectives.
- Agency expectations for an integrated program are not clearly articulated.
- A focus on meeting individual, program-specific targets is overriding the need to accomplish more effective and better-integrated treatments.
- Program planning and budgeting processes are insufficient to evaluate priorities, tradeoffs, and impacts on other programs.
- An integrated, multi-resource approach to landscape- and project-level planning is not occurring everywhere.
- The regional 5-year restoration strategies contain little discussion of how to establish landscape-scale goals.

Such obstacles to treating hazardous fuels and restoring fire-adapted ecosystems likely also apply to other restoration objectives in various program areas. Restoration objectives span a number of initiatives in various program areas, including the invasive species strategy; recovery of areas affected by high-severity fires, hurricanes, and other catastrophic disturbances; fish habitat restoration and remediation; riparian area restoration; conservation of threatened, endangered, and sensitive species; and restoration of impaired watersheds and large-scale watershed restoration projects. A framework is needed to unite these various program-specific initiatives within a cohesive set of policies, definitions, and procedures.

This Restoration Framework, honed with help from many different people (see appendix A), is designed to serve this end. It begins with a comprehensive, science-based definition and explanation of ecosystem restoration, and then recommends a few strategic actions, including:

- adopting a clear, strategic agency-wide policy on ecosystem restoration;
- adjusting budget and performance systems to help integrate various management programs;

- focusing collaborative efforts, where desired and appropriate, on ecosystem restoration;
- using national, forest, and project planning more effectively to engage all of the agency's resources as well as its partners in identifying restoration priorities and getting restoration results; and
- increasing research and science delivery efforts related to ecosystem restoration.

Two fundamental principles pervade this Restoration Framework: First, because restoration needs reflect diverse public values and transcend property lines, ecosystem restoration is based upon collaboration with the public and with partners, including other federal agencies, nongovernmental organizations, and tribal, state, and local governments. Second, scientific knowledge is essential to effective ecosystem restoration and necessarily serves as its basis.

Definition and Guiding Principles

For decades, people have struggled with defining ecosystem (or ecological) restoration. The term appears, explicitly or implicitly, in a wide range of administrative documents and scientific literature (see appendix B), often with strikingly different meanings. In context, each particular usage might make perfect sense; however, the Forest Service's mission requires coherent land management policies and planning nationwide (Forest Service Manual [FSM] 1900, Planning). Therefore, an integrated, agency-wide approach to ecosystem restoration requires a single, unified understanding of the term.

The Restoration Framework Team recommends a definition crafted by the Society for Ecological Restoration (SER) International (SER 2004):[1] Ecosystem (ecological) restoration "***is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed***."

The terms *degraded*, *damaged*, and *destroyed* all represent degrees of deviation from a desired condition for an ecosystem. *Degraded* pertains to subtle or gradual changes that reduce ecological integrity and health. *Damaged* refers to acute and obvious changes in an ecosystem. An ecosystem is *destroyed* when severe degradation or damage removes all macroscopic life and drastically alters the physical environment as well. These terms are used collectively to represent a continuum of conditions.

Several additional terms common to restoration need to be defined. A *reference ecosystem* is a model used to plan an ecological restoration project and later to serve in the evaluation of that project. As Falk (1990) puts it, "Restoration uses the past not as a goal but as a reference point for the future. If we seek to recreate the temperate forests, tall grass savannas, or desert communities of centuries past, it is not to turn back the evolutionary clock but to set it ticking again." When available, reference ecosystems provide a benchmark for determining the magnitude and rate of change in the composition, structure, and function that has occurred in a similar but degraded ecosystem. This information is invaluable for guiding decisions related to ecosystem restoration. Due to climate change, invasive species, extinctions, and social or

[1] SER is a nonprofit professional organization with 2,300 members from 37 countries, including scientists, planners, administrators, ecological consultants, engineers, First Peoples, natural-area managers, and others. SER publishes the peer-reviewed quarterly journal *Restoration Ecology*.

economic factors, a reference ecosystem might not be an appropriate goal or endpoint for restoration. Research natural areas, special interest areas, wilderness areas, or other largely intact terrestrial or aquatic ecosystems can serve as reference ecosystems.

The concept of *historical range of variability* (HRV) is the spatial and temporal variation in ecosystem characteristics over an extended period of time. In FSM 1905, Definitions, the term range of variation is defined as the "spatial and temporal variation in ecosystem characteristics during a period of time when the influences of European-American settlement were minimal." Understanding and characterizing this variation can be helpful when making decisions about restoration; it is often used as a reference condition for restoration. If restored ecosystems are maintained within their HRV, it is assumed that they are more likely to be resilient and sustainable. The range of variability in an ecosystem is determined by time, processes (such as fire and other disturbances), native species, and the land itself. Not all ecosystems will be restored to their reference conditions as defined by the HRV. Social or economic considerations might outweigh ecosystem considerations. For example, a wildland/urban interface that historically had infrequent but high-severity fires is likely to be managed outside of its HRV.

By definition, the goal of ecosystem restoration—whether terrestrial or aquatic—is *ecosystem recovery*. Recovery involves restoring conditions capable of providing desired ecological goods and services. This result is best achieved by taking ecological history and site capability into account. A restored ecosystem should be able to sustain itself over time with minimal intervention, although in some cases active management might be required, such as maintenance burns in fire-adapted ecosystems. Within normal ranges of environmental stress and disturbance, restored ecosystems should be inherently resilient, interacting with surrounding ecosystems in terms of biotic and abiotic flows and cultural settings. By definition, restoration inherently necessitates knowing what was there and how things operated in the past (Foster 1998). Today, an abundance of literature describes methods of reconstructing historical conditions in support of restoration efforts.

In addition to a definition for ecosystem restoration, the Team recommends the following 10 principles for guiding the implementation of restoration projects:

1. Seek and set goals for restoration only as societal choices; public involvement is key.
2. Make operational decisions at the lowest possible levels in an organization.
3. Consider the effects of restoration at local and landscape levels.
4. Give priority to restoring ecosystem processes, such as hydrologic pulses for rivers and streams or prescribed burning for fire-dependent ecosystems.
5. Establish objectives for the long term.
6. Recognize that ecosystems are dynamic and that change is inevitable; avoid "static endpoint" thinking.
7. Use multiple sources of relevant information, such as historical records, scientific studies, practical experience, and indigenous knowledge.
8. Deal with uncertainty by using adaptive approaches to restoration.
9. Design and implement monitoring as part of restoration.

10. Learn as you go.

The global definition of restoration and its associated terms and guiding principles provide the flexibility for an appropriate range of restoration objectives to be sought in accordance with environmental conditions and ecosystem dynamics. They support the land management planning process for setting restoration goals based on public values and input. The definition and guiding principles make allowances for human activities and natural disturbances that, in some cases, have affected landscapes to the point where they might not recover their historical attributes or support the values and services that people want.

Restoration Policy

The Forest Service lacks an integrated agency-wide policy to promote ecosystem restoration. The need for restoration is widely recognized, and the agency has initiated restoration-related activities at various scales. Nevertheless, the concept is neither well understood nor consistently implemented within the agency, partly because the Forest Service's mission, vision, guiding principles, and strategic plans have never been coherently linked to ecosystem restoration. In fact, FSM 1021, Statutory Mission, does not correspond to the mission statement in the Forest Service's national strategic plan.

A well-designed approach to ecosystem restoration is based on a consistent, well-understood mission for the agency. The national strategic plan must incorporate ecosystem restoration in a holistic manner, and agency leaders as well as land managers must reflect it in their thinking and expectations. Deputy areas must be well coordinated and resource functions well integrated. Implementation is facilitated when employees and the public understand the role that ecosystem restoration plays in caring for the land and serving people.

As a first step toward better integrating ecosystem restoration into Forest Service activities, the Forest Service needs a clear and consistent agency-wide restoration policy. Accordingly, the Team makes the following recommendations:

- Revise FSM 1021, Statutory Mission, to conform to the mission statement in the national strategic plan, and add the words "and restore" to the mission statement. In addition, incorporate the concept of ecosystem restoration into the Forest Service's vision and guiding principles. Appendix C contains suggested language for some of the corresponding directives.
- Adopt an agency-wide policy based on the following principles:
  - Ecosystem restoration is a fundamental component of the agency's mission.
  - Ecosystem restoration is defined as "the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed."
  - Ecosystem restoration objectives are based upon public values and desires.
  - Management decisions regarding restoration will be informed by the best available science.

- Strategic plans—including the national strategic plan, land and resource management plans (LRMPs), State and Private Forestry strategic plans, Area plans, and research strategic plans—should articulate ecosystem restoration needs and priorities.
- Resource programs shall coordinate and integrate their respective program objectives, where appropriate, to achieve complementary or synergistic results contributing to ecosystem restoration.
- Active management is often required to achieve ecosystem restoration objectives, and values from commercial uses of natural resources may be used to help fund restoration activities.

Integration and Performance Measures

The magnitude of ecosystem restoration needs greatly exceeds the Forest Service's organizational and financial capacity. Nevertheless, the agency continues to manage its several resource management programs largely as separate, independent, and at times competing or even conflicting activities. To increase ecosystem restoration accomplishments, the Forest Service—at all levels of the agency—must further integrate the capabilities of its various programs to synergistically address the threats to the fundamental values and purposes of the national forests and grasslands. A more integrated and synergistic approach (see appendix D for more detail) can produce greater on-the-ground results—even given current budgetary and organizational limitations.

Better integration would help the agency identify priorities for ecosystem restoration, resulting in greater effectiveness and efficiencies. However, integration does not imply that everything we do is tied to restoration; a focus on ecosystem restoration does not exclude other direction. Integration is not a substitute for understanding ecosystem trends and taking social and economic considerations into account in making land management decisions.

Many ranger districts and supervisor's offices have made excellent progress in integrating their programs. The greatest need is for the Washington Office, regional offices, and research stations to make the same cultural shift. The functional organization of these offices is sometimes cited as an impediment to more effective integration. Some employees believe that better organizational alignment can help promote program integration. However, organizational alignment does not necessarily mean reorganizing the agency. A key objective of any organizational change is a cultural shift—a shift in thinking—to integrate activities across functional areas.

Budget and performance systems are often the most direct and effective means of broadly influencing agency actions. Budget development procedures, program budget direction, and budget allocation principles can provide powerful incentives for aligning agency objectives and actions. Adjustments to budget procedures can motivate program managers and line officers, facilitating their efforts to integrate broad restoration objectives into their program activities. Unless budget procedures are realigned, policy statements might not significantly affect agency activities.

To promote more effective integration among functional programs and to better align budget procedures with restoration policy, the Team makes the following recommendations:

- Empower the Executive Integration Team to further delineate and recommend to the National Leadership Team three strategic approaches to organizational integration:
    1. a strategy for integrated national and regional budget formulation, allocation, and execution, including direct financial incentives for coordinating and integrating program objectives and activities in ways that promote ecosystem restoration;
    2. an organizational alignment that results in an integrated approach to planning and implementing restoration priorities, and a strategy for achieving that alignment; and
    3. a process for proposing strategic restoration outcomes to Congress for multi-year financing and consolidation of budget line items that fund ecosystem restoration, and a strategy for gaining congressional acceptance.
- Update regional 5-year strategies to provide comprehensive restoration objectives tiered to a national strategic goal of ecosystem restoration. Use restoration-needs information aggregated from the updated 5-year strategies as one of the considerations in the budget strategy to be developed by the EIT. The 5-year strategies and land management plans should be compatible and, when appropriate, updated to reflect current needs identified during inventory and monitoring activities.

These recommendations regarding budget procedures and organizational alignment should be buttressed through performance measures and accomplishment-reporting systems that effectively acknowledge and reward efforts to integrate program activities toward the common objective of ecosystem restoration.

By law, the Forest Service is required to account for its activities by reporting accomplishments based on performance measures set forth in the national strategic plan. However, the performance measures in the 2004 Strategic Plan are not well integrated, and some might not be measurable. The value of integrated ecosystem restoration is in the long-term outcomes, which are not captured by current performance measures.

Until recently, accomplishment-reporting systems did not reflect the multiple benefits that often result from restoration activities. Numerous program-specific data systems exist for reporting and tracking accomplishments related to ecosystem restoration. These data systems include INFRA, FACTS, WFRP, SUDS, NFPORS, and others. These systems provide very limited opportunities for reporting multiple benefits from individual activities and thus provide little incentive for integration. Furthermore, existing reporting systems typically do not allow for complete reporting of the work accomplished through collaboration with partners.

Recently, the Forest Service has implemented an additional budget and accomplishment data system known as WorkPlan 3.0. It allows for and encourages the reporting of multiple benefits and accomplishments resulting from individual projects. However, existing databases remain the “database of record” for reporting accomplishments under specific programs. Continuation of these program-specific accomplishment-reporting databases undermines the potential increased efficiency and incentives for integration offered by WorkPlan 3.0.

To further promote more effective integration across program areas, the Team offers the following recommendations regarding performance measures:

- Add performance measures to the national strategic plan that capture progress made toward integrated outcomes on a landscape scale.
- Designate WorkPlan 3.0 as the "database of record" for reporting accomplishments under all resource programs.
- Supplement annual output-based performance measures with multi-year outcome-based performance measures.
- Provide the ability to take performance credit from activities implemented with non-appropriated partnership funds.

Collaboration

Collaboration for ecosystem restoration involves and depends on partners, stakeholders, and others in the decision-making process. From its earliest days, the Forest Service has always promoted such cooperation. The agency's first Chief made very clear that line officers were expected to work closely with private landowners, ranchers, miners, local officials, and other stakeholders in their daily work (Pinchot 1905).

People have always been key in all of our work, from managing the national forests and grasslands to our interactions with states, tribes, and other land managers. Ecosystems are constructs defined in terms of composition, structure, and processes, all of which are subject to human intervention in various ways. One way that people can positively intervene in ecosystems is through ecosystem restoration; however, to be sustainable, land management decisions to promote ecosystem restoration must be made collaboratively, whether for the national forests and grasslands or for adjacent lands through working with adjacent landowners.

In natural resource management, collaboration increasingly refers to a process whereby groups with different interests come together to address management issues across a large geographic region such as a forest, watershed, or landscape (NFF/USDA Forest Service 2005). Through collaboration, groups that might disagree explore their differences, exchange information, identify common interests, and seek common-ground solutions. The goal of collaborative groups is to build and promote a collective vision for how to manage the land. Any discussion about restoration goals must include local communities. Partnerships within the federal boundary and with adjacent landowners are essential to restoring ecosystems in the most effective and efficient manner. In promoting collaboration for ecosystem restoration, the Forest Service can build on community-based fire protection plans and stewardship contracts, as well as the full range of authorities for State and Private Forestry and laws such as the Wyden Amendment.

Accordingly, the Team recommends that the Conservation Education program incorporate the need for ecosystem restoration and its associated values and benefits into its various educational activities.

Planning

Planning on the National Forest System takes place at three levels—the national strategic plan, forest land and resource management plans (LRMPs), and project plans. Incorporating ecosystem restoration into the strategic plan provides a framework for forest LRMPs and hence for on-the-ground project plans.

The national strategic plan establishes agency-wide goals, objectives, and performance measures. Land managers are expected to align their forest LRMPs and their activities on the ground with the agency's strategic goals. Three of the agency's six strategic goals in the 2004 Strategic Plan address distinct restoration needs related to fire and fuels, invasive species, and watershed conditions. However, the strategic plan does not integrate these needs into a separate, clearly articulated, overarching goal of ecosystem restoration. Fuels management activities, for example, though frequently required to reduce fire risk, do not necessarily lead to ecosystem restoration.

Forest LRMPs provide broad guidance and information for project and activity decision-making on a national forest, grassland, prairie, or other administrative unit. Each unit's supervisor is responsible for approving an LRMP and revising or amending it. Concurrence of the appropriate research station director is required for any part of a plan applicable to any experimental forest within the plan area.

Currently, some forest LRMPs include ecosystem restoration needs and objectives, whereas others do not. The 2005 Planning Rule will facilitate the process of incorporating restoration needs into all forest LRMPs by streamlining revision and amendment. Under the Rule, preparing or revising an LRMP starts with writing a comprehensive evaluation report to examine current conditions and help identify any need for changing current plan direction. The next step is to formulate plan components, including desired conditions, plan objectives, guidelines, specifications for suitability of areas, and designations of any special areas. Finally, the Rule calls for an environmental management system for tracking implementation and accomplishment, with the specific objective of continuous improvement. Development of the comprehensive evaluation report, the plan components, and the environmental management system must be interdisciplinary and collaborative.

At every step, ecosystem restoration needs should be considered:

- The comprehensive evaluation report is guided, in part, by requirements under 36 CFR 219.10, Sustainability: "The overall goal of the ecological element of sustainability is to provide a framework to contribute to sustaining native ecological systems by providing ecological conditions to support diversity of native plant and animal species in the plan area." Accordingly, ecosystem restoration needs should be one of the considerations in preparing the comprehensive evaluation report.
- Desired conditions should be integrated and consolidated, incorporating priorities and compromises among resource areas and users. Certainly, restoration needs should be one of the considerations. Any restoration needs should be confirmed and reinforced by sustainability considerations, conservation strategies, and so on.

- Plan objectives identify the priorities for the first 5 to 7 years of plan implementation. The objectives should identify any restoration needs that are urgent as well as critical.
- Guidelines generally set limits on other activities. Any limits or restrictions needed for ecosystem restoration should be either listed or incorporated by reference.
- For each geographic area, the plan specifies uses that are or are not compatible with the identified desired conditions, and restoration needs should figure in. For example, it might be noted that mechanical vegetation treatment is desired for restoration purposes before fire can be introduced, or that motorized use should be limited to prevent the further spread of invasive species.
- Restoration needs should also figure into special-area designations. Establishing research natural areas or other special areas can help managers attain restoration goals. Some special areas, such as botanical areas, may be established by the official responsible for the plan, whereas others require approval by the Chief, Department, or Congress.
- Although little is yet known about environmental management systems, how they will be used by the agency, or what the associated expectations of the public and agency partners will be, ecosystem restoration needs should be considered in setting them up.

The national strategic plan and forest LRMPs provide broad guidance but do not normally approve site-specific project activities. Proposed projects are analyzed and documented based on the requirements of the National Environmental Policy Act. Because proposed projects must either comply with the forest LRMP or specifically provide for an LRMP amendment, any restoration needs can be identified either in a forest LRMP directly or through project proposals and any corresponding amendment required.

To better integrate ecosystem restoration into the Forest Service's planning processes, the Team makes the following recommendations:

- Revise the national strategic plan to integrate restoration needs into a single overarching goal of ecosystem restoration, together with appropriate objectives and performance measures.
- For LRMPs that are being revised, incorporate language into FSM 1920 and FSH 1909.12 directing land managers to:
  - use a comprehensive evaluation report to identify restoration needs; and
  - incorporate restoration needs into desired conditions and objectives, suitability of areas for various uses, guidelines, and special areas.
- For LRMPs that do not currently address restoration needs and are not being revised in the near future, direct land managers to:
  - initiate a comprehensive evaluation report, as appropriate, to identify restoration needs; and
  - based on results from the report, consider amending the plan to address restoration needs.
- For all National Forest System units, direct managers to consider incorporating restoration needs into their environmental management systems as they transition to the 2005 Planning Rule.

Research and Development

The science of restoration has emerged in recent years with a growing body of research and application that emphasizes multiple spatial scales, integrating the ecological and social sciences, and restoring processes that provide for ecosystem health, integrity, and sustainability. Scientists within the restoration community as well as other resource professionals have challenged the notion of naturalness as a restoration objective. At the crux of the debate is the question of whether naturalness represents a scientifically defensible concept or is simply a statement of preference for one kind of ecosystem over another. Furthermore, some scientists are moving away from the purist position that the goal of restoration is an idealized pristine state, which implies a static rather than a dynamic view of ecosystems.

A major research need is to develop general guiding principles for restoration that will move us beyond the *ad hoc*, site- and situation-specific approaches that now predominate. In conjunction with practitioners, researchers need to develop restoration methodologies that are applicable at multiple spatial scales, from local sites to landscapes. Other critical needs include understanding the processes leading to degradation, determining realistic goals and measures of success, developing methods for implementing the goals and incorporating them into land management and planning strategies, and monitoring the restoration to assess its success.

Accordingly, the Team makes the following recommendations for research and development:

- Designate the newly established Forest Environmental Threat Assessment Centers as primary contact points for restoration research and development within the Forest Service.
- Use the Forest Inventory and Assessment program to furnish information on the status and trends of the nation's forests and to provide reference conditions for ecosystem restoration.
- Use regional assessments to provide contextual frameworks for local restoration projects.
- Provide the support necessary to develop a cohesive program of restoration research and development within the Forest Service.
- Strengthen partnerships among the National Forest System, Research and Development, and State and Private Forestry to better conduct restoration studies at both local and landscape scales.

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Appendix A—Consultants, Reviewers, and Support for the Restoration Framework Team

The following individuals made key contributions to the Team's work. Members of the Executive Integration Team provided vision and guidance, allowing the Team to fully explore the problem of ecosystem restoration. Other contributors served as consultants or reviewed early drafts of this report, either in whole or in part. Still others provided logistical support, such as facility arrangements, graphics, and note-taking.

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Appendix B: Relevant References

A fundamental task is to define the term ecosystem restoration, because all restoration-related tasks tier from the definition. Over the years, many different definitions have emerged, reflecting different philosophies, professional judgments, and values. To facilitate its task of defining restoration, the Team searched for commonly used or referenced definitions for comparison and contrasting.

A website of terms related to national forest management (<http://www.reo.gov/general/definitions_r-s.htm>) defines "restoration (of ecosystems)" in terms of "actions taken to modify an ecosystem to achieve a desired, healthy, and functioning condition." In addition, the Team found the various definitions listed below, categorized by source: initiatives by or involving the Forest Service; directives associated with the Forest Service Manual (FSM) and Forest Service Handbook (FSH); and professional societies and scientific literature.

Initiatives

Past and ongoing land management initiatives by or involving the Forest Service have variously defined restoration, either implicitly or explicitly. Listed in chronological order, they document the term's evolution within the agency.

1. Protecting People and Sustaining Resources in Fire-Adapted Ecosystems: A Cohesive Strategy (signed by former Chief Mike Dombeck on August 22, 2000) defines restoration as "the return of an ecosystem or habitat toward: its original structure, natural complement of species, and natural functions or ecological processes."

2. Managing the Impacts of Wildfires on Communities and the Environment: A Report to the President in Response to the Wildfires of 2000 (known as the National Fire Plan, signed by the Secretaries of Agriculture and the Interior on September 26, 2000) states that restoration "involves using appropriate rehabilitation techniques to obtain a healthy community or ecosystem on a long-term basis."

3. A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: 10-Year Comprehensive Strategy (August 2001) and its companion Implementation Plan define restoration as "the active or passive management of an ecosystem or habitat toward its original structure, natural compliment of species, and natural functions or ecological processes (Cohesive Strategy, 2000)."

4. The Healthy Forests Initiative (2002) and Healthy Forests Restoration Act of 2003 use the term restoration extensively and thus provide implicit definitions, although neither document explicitly defines restoration.

5. An interagency working group was commissioned by the Interagency Fuels Committee to develop a classification known as Fire Regime Condition Class (FRCC) for determining the degree of departure from reference conditions based on historical fire regimes. The resulting FRCC reflects changes to vegetation characteristics (species composition, structural stages, stand

age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and pattern; and/or other associated disturbances (e.g., insect and diseased mortality, grazing, and drought). The three classes are based on low (FRCC 1), moderate (FRCC 2), and high (FRCC 3) departure from the central tendency of the historical fire regime. The central tendency is a composite estimate of vegetation characteristics (species composition, structural stages, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and pattern; and other associated disturbances. Low departure is considered to be within the historical range of variability, whereas moderate and high departures are outside.

Based on FRCC, characteristic vegetation and fuel conditions are within the historical fire regime. Uncharacteristic conditions did not occur within the historical fire regime, such as invasive species (e.g. weeds, insects, and diseases); "high-graded" forest composition and structure (e.g., large trees removed in a frequent surface-fire regime); or repeated annual grazing sufficient to reduce grassy fuels across relatively large areas such that they will not carry a surface fire. To determine the amount of departure, a composite measure of fire regime attributes (vegetation characteristics, fuel composition, and fire frequency, severity, and pattern) is compared to the central tendency of the historical fire regime. The amount of departure is then classified to determine FRCC. For more information on FRCC, go to <http://www.frcc.gov>.

Directives

Based on the 2005 Planning Rule and other regulations, the Forest Service has used "restoration" and related terms in a number of FSM and FSH directives.

1. FSM 1900 (Planning) uses the term restoration once without defining it.

2. FSM 1920 (Land Management Planning) uses the term restoration nine times without specifically defining it. Sections 1921.7 (Sustainability) and 1921.8 (The Role of Science) contain the most pertinent text.

3. FSM 2523.05 (Watershed Protection and Management) defines restoration as "the continuation of rehabilitation activities beyond the initial 3 years or the repair and replacement of major facilities damaged by fire. Restoration is financed using non-emergency funding."

4. FSH 1909.12 (Land Management Planning Handbook) uses the term restoration a number of times without specifically defining it. "Restoration" is used 16 times (10 times in chapter 10, 3 times in chapter 40, and 3 times in chapter 60). Sections 43 (Ecosystem Sustainability) and 43.1 (Ecosystem Diversity) contain text pertinent to restoration.

Professional Societies/Scientific Literature

1. The Society of Ecological Restoration (SER) provides a comprehensive collection of materials that overview, define, and provide guidelines on ecological restoration (<http://www.ser.org>). The *SER International Primer on Ecological Restoration* defines ecological restoration as "the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed." It also provides definitions of related terms along with a useful listing of attributes of

a restored ecosystem. Project-planning steps for ecological restoration are listed in a companion document, *A Society for Ecological Restoration Publication: Guidelines for Developing and Managing Ecological Restoration Projects*.

Tenets of the SER Primer have been questioned and professionally debated. Davis and Slobodkin (2004) argued that "defining restoration goals and objectives is fundamentally a value-based, not scientific, activity." As such, they relegated science to the implementation phase of restoration. Winterhalder et al. (2004) admitted that formulating restoration goals is primarily a value-based social exercise but dismissed the contention that scientific efforts should be confined to implementation of restoration objectives. They argued that "restoration practitioners employ science from start to finish" and that "[t]he selection of a reference condition on which restoration can be modeled is largely an ecological enterprise."

2. In a list of definitions for restoration, the Center for International Forestry Research cites a definition by the Willamette Restoration Initiative in Oregon as "the process of repairing damage to the diversity and dynamics of ecosystems" (WRI 1999). Restoration aims to return the ecosystem as much as possible to predisturbance conditions and functions. Implicit in this definition is that ecosystems are naturally dynamic; it is therefore not possible to recreate a system exactly. The restoration process reestablishes the general structure, function, and dynamic but self-sustaining behavior of the ecosystem. Restoration differs from rehabilitation in that restoration is a holistic process not achieved through the isolated manipulation of individual elements. Whereas restoration aims to return an ecosystem to a former natural condition, rehabilitation implies putting the landscape to a new or altered use to serve a particular human purpose.

3. Gilmour et al. (2000) use the following definition of restoration: "To re-establish the presumed structure, productivity and species diversity of the forest originally present at a site. The ecological processes and functions of the restored forest will closely match those of the original forest."

4. According to the International Tropical Timber Organization, forest restoration entails a management strategy applied in degraded primary forest areas to restore the forest to its state before degradation, with the original function, structure, and composition (ITTO 2002).

5. Referring to restored natural or secondary forests, Poulsen (2002) states that "[r]estored forest, through either planting or/and seeding, or through natural regenerating process, where restoration aims to create a species mix and ecology approaching that of the original natural forest."

6. A 2002 workshop by the World Wildlife Federation and the World Conservation Union concluded that forest landscape restoration is "[a] planned process that aims to regain ecological integrity and enhance human well being in deforested or degraded forest landscapes" (WWF/IUCN 2001).

7. On its website, the Forest Restoration Information Service (part of the United Nations Environment Programme) refers to the role of restoration as reestablishing the presumed structure, productivity, and species diversity of the forest originally present at a site (FRIS 2005).

In time, the ecological processes and functions of the restored forest are to closely match those of the original forest.

8. According to the Natural Resources Conservation Service, “The objective of ecosystem restoration is to restore and maintain the physical, chemical, and biological conditions necessary to allow a natural and native ecosystem to function and evolve over time (NRCS 2005).”

9. What is forest landscape restoration? Maginnis (2005) answers the question by making the following observations:

- Centuries of land use have greatly altered the composition and structure of many landscapes.
- In some cases, forest health as measured by productivity has been degraded. This results in the loss of benefits and services to people.
- Forest landscape restoration seeks to create a framework whereby ecological integrity can be regained and human well-being enhanced in deforested or degraded forest landscapes.
- The focus is on restoring forest functionality—that is, the goods, services, and ecological processes that forests can provide at the broader landscape level.
- The landscape is the unit at which social, economic, and environmental tradeoffs should be equitably balanced.
- The forest landscape restoration approach is a flexible package of site-based techniques—from pure ecological restoration through blocks of plantations. The combined contribution has landscape-scale impacts.

Appendix C: Restoration Policy

The Forest Service Manual (FSM) codifies agency policies and regulations in directives designed to guide actions in the field. Individual sections in the FSM often address policy, definitions, and responsibilities. Corresponding language related to ecosystem restoration is suggested below for integration into FSM, 1000 series.

Policy

1. Ecosystem restoration is a fundamental component of the agency's mission.

2. Ecosystem restoration objectives shall be based upon public values and desires.

3. Ecosystem restoration activities shall be planned, implemented, and evaluated using reference conditions.

4. Strategic plans—including the national strategic plan, land and resource management plans, and research strategic plans—shall articulate ecosystem restoration needs and priorities.

   a. The national strategic plan shall reinforce the need for restoration activities and provides goals and objectives that respond to these needs.

   b. Land and resource management planning processes and decisions shall refine the need for restoration activities, including their extent and location, to achieve desired conditions.

5. Resource programs shall coordinate and integrate their respective program objectives, where appropriate, to achieve complementary or synergistic results contributing to ecosystem restoration. Restoration activities are planned and implemented using an integrated interdisciplinary approach that maximizes, to the extent possible, the involvement and participation of staff and resources.

6. Active management is often required to achieve ecosystem restoration objectives. Values from commercial uses of natural resources may be used to help fund restoration activities.

7. Activities designed to promote ecosystem restoration are among many desired activities on the National Forest System.

Definitions

8. Ecosystem restoration, as the term is used in the Forest Service, is defined as follows:

   Ecosystem restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.

9. Ecosystem restoration activities apply to all proposed actions that help recover an ecosystem that has been degraded, damaged or destroyed.

Responsibilities

10. Ecosystem restoration activities and projects tier from the Forest Service's mission, vision, and guiding principles.

11. Ecosystem restoration activities are planned, implemented, and monitored using information, advice, and support from all branches of the Forest Service (National Forest System, State and Private Forestry, and Research) using the best available science.

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12. Ecosystem restoration activities are planned, implemented, and monitored using a collaborative approach working with other federal agencies, state and local governments, tribal governments, and other interested parties. The public shall be informed of the progress of environmental analyses and decision-making and evaluations involving ecosystem restoration activities.

Appendix D: Integration of Ecosystem Restoration into Larger Programs

Restoration must be accomplished in the context of multiple-use management. For example, restoring a watershed to correct erosion problems requires restoring soil and vegetation components for cleaner water, which in turn supports fish, recreation, livestock, and municipal water supplies. Restoration design can usually take specific wildlife habitat needs into account. In many cases, however, only one or two of several multiple uses might be involved, depending on the specific restoration need and the direction in the forest plan. Also, in some cases restoration might address both short- and long-term needs. For example, restoration following a wildfire will address both short-term needs such as grass seeding and erosion control measures and long-term needs such as reforestation.

The Multiple Use–Sustained Yield Act of 1960 directs the Forest Service to take multiple uses into account when designing and implementing restoration projects:

- "It is the policy of the Congress that the national forests are established and shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes."
- "The Secretary of Agriculture is authorized and directed to develop and administer the renewable surface resources of the national forests for multiple use and sustained yield of the several products and services obtained there from. In the administration of the national forest due consideration shall be given to the relative values of the various resources in particular areas."

The Act also envisions cooperation beyond the boundaries of the national forests: "In the effectuation of this Act the Secretary of Agriculture is authorized to cooperate with interested State and local governmental agencies and others in the development and management of the national forests."

The National Forest Management Act of 1976 notes an important research component, directing in section (4) that "the new knowledge derived from coordinated public and private research programs will promote a sound technical and ecosystem base for effective management, use and protection of the Nation's renewable resources." In section (5), the Act states that the federal government should be a catalyst to encourage and assist private, state, and local governmental management in the efficient long-term use and improvement of these lands and their renewable resources consistent with the principles of sustained yield and multiple use.

Based on these statutes, restoration projects on national forest land:

- must fit into the bigger picture of adaptive management derived from research;
- should take not only the needs of national forest lands into account, but also the needs of lands beyond the federal boundary; and
- be a catalyst and example for private, state, and local land management in a multiple-use context.

In view of the larger picture, restoration projects can be funded in multiple ways. Where restoration needs overlap or involve several resources, sharing the appropriated financing

allocated for the affected resources is essential for significant restoration progress. Commercial activities such as timber sales can contribute to completing all or part of the restoration work identified within the sale area. Authorities associated with the timber sale program (such as KV) allow work to be done for other resource needs. The work could address restoration needs identified in the environmental documents associated with the sale.

Another key tool available for restoration activities is stewardship contracting, which allows both the exchange of goods for services and best value contracting. Stewardship projects can focus on restoration and use the value from timber to pay for restoration services. Stewardship contracting is oriented toward long-term outcomes, so it fits the need for efforts that will take years to complete. Stewardship contracts can be awarded with timeframes of up to 10 years. They can also be coordinated with activities planned outside national forest boundaries with private landowners, and they can take advantage of State and Private Forestry grants.

However, realignment of budget structures and multiple-year financing are needed to better facilitate long-term restoration outcomes. Restoration priorities will be needed, along with the corresponding priority-setting criteria. Presidential initiatives and high-visibility needs can be given extra weight as needed to ensure that they receive sufficient attention.