CHAPTER 3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter describes the environment that would be affected by each of the alternatives, and describes the effects of each alternative on the environment. To assist readers' understanding of the discussion on the effects of the alternatives on the environment, the first part of this chapter provides a discussion of how a planning rule fits in with laws and other regulations and the staged decisionmaking process of the rule, plans, and projects. It also discusses the challenges to describing the effects of a planning rule, and the methodology used in this chapter to describe effects. The literature cited in this section is not meant to be a comprehensive list of all available literature on the subject. Instead, it is intended to provide the decisionmaker with the representative range of scientific knowledge and opinion on the topic.

CONTEXT

Consideration of the effects of the alternatives must include consideration of the statutory and regulatory context in which it would operate. While laws other than the National Forest Management Act (NFMA) do not dictate the content of a planning rule, they will greatly influence what may or may not occur on National Forest System (NFS) lands. How these statutes and regulations affect Forest Service actions, and therefore the environment, must be taken into account when determining the effect of the alternatives. In addition, the necessity of staged decisionmaking–from rule, to plans, to projects and activities–affects the extent to which effects of the alternatives can be disclosed.

Hierarchy of Direction

While land management plans influence the choice and design of future proposals and decisions concerning projects and activities in a plan area, they do so within a hierarchy of laws, regulations, and Agency policies.

At the top of this hierarchy, after the United States Constitution, are the relevant statutes. There is no discretion in compliance with the law; statutory requirements are mandatory and must be followed. Some of the principal laws that responsible officials must follow when authorizing projects and activities on NFS lands include the Clean Air Act of 1955 as amended (42 U.S.C. 7401 et. seq.); the Multiple-Use Sustained-Yield Act of 1960 (16 U.S.C. 528 et seq.); the Wilderness Act (16 U.S.C. 1121 et. seq.); the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.); the Endangered Species Act of 1973 as amended (16 U.S.C. 1531 et seq.); the Forest and Rangeland Renewable Resource Act of 1974 as amended by NFMA (16 U.S.C. 1600 et seq.); and the Clean Water Act of 1948 as amended by the Federal Water Pollution Control Act Amendments of 1977, the Water Quality Act of 1987 and other laws (33 U.S.C. 1251 et seq., 1323 et seq.), and the National Historic Preservation Act of 1966 as amended (16 U.S.C. 470 et seq.). Compliance with law is a constant among all of the alternatives.

Compliance with law, regulation, and policy has an important bearing on the range of effects that can be expected from each of the alternatives. For example, compliance with the Endangered Species Act and associated regulations means that the Forest Service must ensure that no action authorized, funded, or carried out would be likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of critical habitat. Similarly, compliance with the National Historic Preservation Act and associated regulations means the Forest Service will consult with appropriate State historic preservation officers and tribal historic preservation officers concerning any actions with the potential to affect historic properties.

Federal agencies have adopted regulations, found in the Code of Federal Regulations (CFR), to carry out many of these laws. Title 36 CFR Parts 200 to 299 contain regulations specific to the Forest Service. Not only must the Forest Service comply with its own regulations, but it also must comply with other applicable regulations. For example, in complying with the Endangered Species Act's Section 7 consultation requirements, the Forest Service must follow the process set out in regulation at 50 CFR Part 402. Similarly, 36 CFR Part 800 guides compliance with the Section 106 requirements of the National Historic Preservation Act.

With one possible exception, this proposed revision of 36 CFR Part 219 – National Forest System Land Management Planning – or the alternatives would not change or amend any other regulations. The possible exception is a provision of the Forest Service National Environmental Policy Act implementing regulations at 36 CFR Part 220.5(a) – Classes of Actions Normally Requiring Environmental Impact Statements. If the final planning rule includes a requirement to prepare an environmental impact statement for approval of new plans and plan revisions, a conforming amendment of § 220.5(a) would be appropriate to add this type of action to the list of actions that normally require preparation of an environmental impact statement. Other regulations concerned with Forest Service resource management such as those found at 36 CFR Part 212 – Travel Management, Part 222 – Range Management, Part 223 – Sale and Disposal of National Forest System Timber, Part 251 – Land Uses, Part 293 – Wilderness – Primitive Areas, and Part 294 – Special Areas would not change. Decisions authorizing projects and activities on NFS

lands must comply with these and other applicable regulations. (The CFR is available online at http://www.gpoaccess.gov/cfr/.) Compliance with regulations is a constant among all of the alternatives.

In implementing plans for a unit, responsible officials must ensure that project and activity proposals comply not only with laws and regulations, but also with Agency policy. Agency policy is specified in manuals in the Forest Service Directive System, available at http://www.fs.fed.us/im/directives/dughtml/serv_fsm.html. Forest Service directives are the primary basis for the Forest Service's internal management of all its programs and the primary source of administrative direction to Forest Service employees. The Forest Service Manual (FSM) contains legal authorities, objectives, policies, responsibilities, instructions, and guidance needed on a continuing basis by Forest Service line officers and primary staff to plan and execute programs and activities. Just as regulations must follow laws, Agency policies must follow laws and regulations. Compliance with Agency policies is a constant among all of the alternatives.

Similar to a proposed planning rule, many proposed changes to Agency policy are subject to a public review and comment process. The NFMA requires the Secretary of Agriculture to establish procedures in regulation to give Federal, State, and local governments and the public adequate notice and an opportunity to comment upon the formulation of standards, criteria, and guidelines applicable to Forest Service programs (16 U.S.C. 1612(a)). These regulations, found at 36 CFR part 216, require publication of a notice in the *Federal Register* and a 60-day review and comment period for proposed manual and handbook directives of substantial public interest (§ 216.6(a)).

Land management plans developed for each unit of the NFS are a part of this hierarchy, and are developed in compliance with laws, regulations, and policy. Land management plans provide broad guidance to the Forest Service for project and activity decisionmaking in a national forest, grassland, prairie, or other administrative unit.

Staged Decisionmaking and Environmental Analysis

Stages in Land Management Decisionmaking

Adoption of a planning rule is the first in a series of decisions for managing National Forest System lands. NFMA requires the promulgation of a planning rule that "set[s] out the process for the development and revision of the land management plans, and the guidelines and standards" set out in the Act. The rule must be developed "under the principles of the Multiple-Use Sustained-Yield Act" (16 U.S.C. 1604(g)). A planning rule sets out requirements for development, revision, and amendment of land management plans. By setting out substantive and procedural requirements, it establishes the decision space within which the planning process is to be carried out and within which plan content must fit. Approval of a planning rule will guide development, revision, and amendment of land management plans.

The rule narrows the decision space available to Forest Service managers at the plan-level stage of decisions. That decision space, although narrowed, is nonetheless broad. The rule must allow for multiple use management of the National Forest System, which

includes 193 million acres of widely varied ecological and social conditions. A new rule is also expected to govern plan creation, revision, and amendment and remain relevant over the next several decades.

At the second stage of decisionmaking, within the requirements set out in the planning rule, a land management plan sets out a framework with sideboards to guide all natural resource management activities on a NFS unit. Approval of a land management plan is a programmatic decision that identifies desired conditions, sets goals and objectives, establishes standards and guidelines, and determines what and how often to monitor certain conditions. A plan guides the choice and design of future proposals for projects and activities in a plan area but typically does not authorize projects or activities, nor commit the Forest Service to take action. A plan constrains the Agency, however, by prohibiting the authorization of certain types of projects or activities or limiting the manner in which they may be carried out, in all or part of the plan area.

As required by NFMA, plans must "provide for multiple use and sustained yield of the several products and services obtained there from in accordance with [MUSYA], and in particular, include coordination of outdoor recreation, range, timber, watershed, wildlife and fish, and wilderness" (16 U.S.C. 1604(e)(1)). Plans therefore must reflect the MUSYA mandate to give "consideration . . . to the relative values of the various resources in particular areas" and provide for management for multiple uses of renewable resources "in the combination that will best meet the needs of the American people."

As a planning rule establishes the decision space for land management planning, land management plans establish further constraints upon the decision space for on-the-ground management decisions. Yet, as the multiple-use principle necessitates a broad decision space for plans, plans will also provide broad decision space. As the Tenth Circuit has observed, a plan "embraces 'an immense scope of projected activity.'" *Forest Guardians v. Forsgren*, 478 F. 3d 1149, 1165, n. 9 (10th Cir. 2007), quoting *Norton v. Southern Utah Wilderness Alliance*, 542 US 55, 70 (2004).

At the third decisionmaking stage are authorizations of on-the-ground projects and activities. Decisions in this third stage must be consistent with the applicable land management plan. Site-specific decisions on any one unit can cover a wide variety of actions. The number of such decisions, made during the life of a plan, can number into the hundreds, and vary widely by type.

At each stage—from NFMA to planning rule, planning rule to plan, and plan to project—the decision space narrows. Even so, the decision space remains broad. Every one of the plans developed to date has differed from the others, and the project decisions that have been under each plan have varied widely.

Tiered NEPA Compliance for Staged Decisionmaking

Each stage of the Agency's decisionmaking process (rule, plans, and projects) is subject to the requirements of the NEPA. As the rule narrows the decision space for plans, and each plan narrows the decision space for projects, so too the NEPA analysis narrows at each stage, through "tiering." Tiering of NEPA analysis is provided for in the Council on

Environmental Quality regulations, and refers to the coverage of general matters in broader environmental impact statements (such as this), with subsequent narrower statements or environmental analyses (such as those for plans) incorporating by reference discussions in the broader document "to eliminate repetitive discussions of the same issues and to focus on the actual issues ripe for decision at each level of environmental review"(40 CFR 1502.20). Tiering is appropriate when the sequence of statements or analyses is: from a program, plan, or policy environmental impact statement to a program, plan, or policy statement or analysis of lesser scope or to a site-specific statement or analysis (40 CFR 1508.28). The Council on Environmental Quality's 1981 scoping guidance also acknowledged the process of staged decisionmaking with the following: "Many people are not familiar with the way environmental impact statements can be 'tiered' under the NEPA regulations, so that issues are examined in detail at the stage that decisions on them are being made. See Section 1508.28 of the regulations. For example, if a proposed program is under review, it is possible that site-specific actions are not yet proposed. In such a case, these actions are not addressed in the EIS on the program, but are reserved for a later tier of analysis" (Council on Environmental Quality 1981b).

For each tier of NEPA analysis (rule, plans, and projects), each decision becomes more specific and its effects can be described with more certainty and specificity. Furthermore, at each level, environmental analysis informs the decisionmaker whether the decision to be made is consistent with overarching direction: the decision to approve a planning rule must be consistent with the law; a decision to approve a plan revision must be consistent with the planning rule; and a decision to approve a project must be consistent with the applicable land management plan.

This final programmatic environmental impact statement (PEIS) discloses the results of a programmatic environmental analysis concerning anticipated effects of a proposed planning rule and alternatives thereto. However, while a planning rule guides development of forest plans, a planning rule itself does not irreversibly or irretrievably commit any resources.

The development of a land management plan is accompanied by programmatic environmental analysis of the effects of the decisions made within the decision space allowed by the rule. Finally, for each proposed project or activity, the Agency undertakes yet another environmental analysis, to determine the site-specific effects. And, it is at that project-specific stage where the bulk of Forest Service NEPA effects analysis is, and will continue to be, done. Only at the point of making project-level decisions does the Agency commit resources or funding for on-the-ground action. It is at this level of NEPA analysis that direct effects can be predicted with confidence to the constituent parts of the environment: the soil, air, water, vegetation, wildlife, social conditions, and economic costs/returns.

Uncertainty in Describing Effects

CEQ NEPA regulations at Sec. 1502.22 (Incomplete or Unavailable Information) contemplate uncertainty, and require an agency, when evaluating reasonably foreseeable significant adverse effects of a proposed action, to obtain incomplete or unavailable

information when such information is essential to making a reasoned choice among alternatives – or to explain why such information cannot be obtained. While some effects of a planning rule can be determined at this time, including effects on the planning process and plan content, as well as some general assertions regarding expected effects on resources over time, the information on more site specific effects cannot be known at the point of rulemaking. Based on the above descriptions of staged decisionmaking and accompanying tiered NEPA analyses (see "Stages in Land Management Decisionmaking" and "Tiered NEPA Compliance for Staged Decisionmaking" in this chapter), any incomplete or unavailable information is not essential to making a reasoned choice among alternatives analyzed in this PEIS.

Changes in ecological conditions as well as changes in social perspectives regarding management of NFS lands provide additional uncertainty at the programmatic stage of decisionmaking. Changes in natural disturbance regimes have become increasingly common, and it is likely that such changes will continue. Changes in ecological conditions include such things as the frequency, scope, intensity, and dynamics of wildfires, insect infestations, the spread of invasive exotic species, the abundance or lack of water, and climate change. However, the location, rate, extent, and most importantly, the effects of those changes are impossible to project at this time.

Changes in social and economic conditions can also affect conditions on the NFS. Such changes include everything from changes in the world economy to changes in demographics—not only of those who use NFS lands but also of communities that depend on NFS lands for their livelihoods. Water shortages may shift land use patterns. Developments of technologies that expand or change demands for renewable and non-renewable energy may dramatically alter demands on NFS lands that we cannot predict at this time. Finally, change in law, policy, and practices could also change land management in ways that cannot be predicted at present.

Methodology for Displaying Impacts

In this PEIS, the Forest Service is grappling with an issue that has challenged it in the development of every prior planning rule: given that actual impacts on the environment are two stages removed from a planning rule, and given that many variables and uncertainties lie within those stages: "what is the most appropriate way for a planning rule's environmental effects to be described?"

The Agency recognizes the high level of public concern regarding the environmental analyses conducted for the previous planning rules, as well as the draft PEIS for this planning rule. In an effort to address that concern, the Agency explored a wide variety of methodologies for displaying the environmental impacts of this program level decision, including:

- Conducting a review of the programmatic EISs conducted by other agencies, including the Programmatic EA for Farm and Ranch Lands Protection Program (Natural Resource Conservation Service 2009), The Non-Project Final Environmental Impact Statement Aquatic Reserves Program Guidance (Washington Department of Natural Resources Aquatic Resources Program

2002), the final PEIS for Benefits Sharing (USDI National Park Service 2009), the Programmatic Environmental Impact Statement (PEIS) for the Designation of Energy Corridors on Federal Land in 11 Western States (DOE/EIS-0386), and others. These assessments and statements analyze effects from actions similar in nature to a planning rule and use similar methods as used in this PEIS, or display more broad or generalized effects than this PEIS.

- Seeking the advice of concerned publics and experienced NEPA and field practitioners. Many in the public offered criticisms such as "the draft PEIS fails to take the hard look required by NEPA" or "the final PEIS must provide improved scientific information and analysis to meet the requirements of NEPA," but none offered examples or alternative methods for analyzing effects with greater specificity or reliability. Agency planning and NEPA practitioners, representing decades of experience, overwhelmingly caution against making unsupportable assumptions in an attempt to increase the specificity of this analysis.
- Forming the Federal Interagency Working Group (FIWG) in June 2010. This group consisted of 21 agencies who were involved in the planning rule clearance process, such as Bureau of Land Management, Council on Environmental Quality, U.S. Fish and Wildlife Service (USFWS), NOAA Fisheries, Environmental Protection Agency, Bureau of Reclamation, Advisory Council on Historic Preservation, Department of Justice, and others. The FIWG provided a forum for early discussion and resolution of issues among the Federal agencies affected by the planning rule. A significant purpose of the FIWG stated in its charter included "defining an appropriate analysis framework for the environmental impact statement." The FIWG met nine times over the course of the rulemaking process and PEIS development. Information and ideas were shared by FIWG agencies to assist the Forest Service in developing this programmatic effects analysis framework. In addition, over two dozen meetings with individual FIWG agencies were held throughout the rulemaking process to provide updates on rule status and progress and resolve issues, including how to describe the effects of a national planning rule.
- Consulting with NOAA Fisheries and USFWS under ESA Section 7. Beginning in September 2010, the USFWS, NOAA Fisheries, and the Forest Service held over a dozen meetings to collaborate on the ESA consultation. Part of the initial discussions centered on how to come to agreement on a framework to analyze and describe the environmental effects of a national planning rule on the 430 listed species whose habitats include NFS lands. These discussions contributed to the analysis framework, effects analysis, and description in this PEIS. Formal consultation under Sections 7(a)(1) and 7(a)(2) was initiated on July 27, 2011 when the Agency submitted a biological assessment to the USFWS and NOAA Fisheries.
- Conducting a review of plans created under the 1982 rule to determine differences between earlier plans and those more recently revised, as well as to seek examples of links between rule language, resulting plan content, and effects of implementing those plans. This review highlighted, for the reviewers, the

speculative nature of trying to link finer scale effects directly to a planning rule and clearly demonstrated that land management planning is influenced not only by a planning rule, but also is greatly influenced by existing and proposed legislation, current Agency policy, current scientific knowledge, shifting public values, and existing ecological conditions.

- Reviewing a number of recently revised land management plans along with their attendant environmental analysis and decision documents, in order to inform discussions concerning how current plans address certain topics in this chapter. To ensure that the plans in the sample represented a cross-section of Agency planning, the most recently revised plans from each Forest Service region were initially selected. However, no plans have been revised in the Agency's Southwest Region or its Pacific Northwest Region. Both of the two plans from the Agency's Alaska Region were omitted because their unique environment is not representative of uses and resources found throughout the other Forest Service Regions. The sample is as follows:

  - Beaverhead-Deerlodge, 2009, Montana (USDA Forest Service 2009a);
  - Bighorn, 2005, Wyoming (USDA Forest Service 2005b);
  - Wasatch-Cache, 2003, Utah (USDA Forest Service 2003);
  - Finger Lakes, 2006, New York (USDA Forest Service 2006a);
  - Green Mountain, 2006, Vermont (USDA Forest Service 2006b).
  - Angeles-San Bernardino, 2005, California (USDA Forest Service 2006c);
  - Croatan, 2002, North Carolina (USDA Forest Service 2002c);
  - Ouachita, 2005, Arkansas and Oklahoma (USDA Forest Service 2005c); and
  - Allegheny, 2007, Pennsylvania (USDA Forest Service 2007a).

  The results of the review of the recently revised plans is discussed in Chapter 3 and are used to set the baseline for displaying the effects of Alternative B (No Action Alternative) as implemented; display the variability in the implementation of Alternative B; and provide the basis for the assumptions on the variability of implementing the action alternatives.

Scope of Effects

Review of Court Findings on Programmatic NEPA Similar to a Planning Rule

An Agency's planning and management decisions may occur at two distinct administrative levels:

1) The "programmatic level" at which the [agency] develops alternative management scenarios responsive to public concerns; analyzes the costs, benefits, and consequences of each alternative in an [EIS]; and adopts an

amendable [management] plans to guide the management of multiple use resources; and

2) The implementation stage during which individual site-specific projects, consistent with the [management] plan, are proposed and assessed.

Ecology Ctr., Inc. v. United States Forest Serv., 192 F.3d 922, 923 n. 2 (9th Cir. 1999).

An EIS for a programmatic plan must provide "sufficient detail to foster informed decisionmaking," but "site-specific impacts need not be fully evaluated until a critical decision has been made to act on site development." *N. Alaska Envtl. Ctr. V. Lujan,* 961 F.2d 886, 890-91 (9th Cir. 1992); see also *Resources Ltd., Inc. v. Robertson,* 35 F.3d 1300, 1306 (9th Cir. 1993).

This PEIS—for a proposed action of greater scope and covering a broader area—cannot provide a fine-scale analysis displaying specific environmental effects on the landscape. Nevertheless, a comparison of the alternatives aids the decisionmaking process by allowing for some understanding of the scope of possible future effects on the environment that may follow the rule, subsequent forest plan revisions, and ultimately, project decisions.

For this PEIS the Agency drew upon its extensive history, experience, and technical expertise to conclude that the methodology used in this chapter is the most practical and helpful way to describe and compare the likely effects of the alternatives.

How Effects Are Displayed

This chapter of the PEIS displays effects of the alternatives in two ways:

Effects of the Rule on the Planning Process and on Plan Content

A planning rule guides the process used to create, revise, or amend land management plans and sets requirements for plan content. For example, if an alternative includes a requirement that an assessment will be conducted prior to plan revision, then it can be expected that an assessment will be conducted for each and every plan revision, and that the information will be used in the revision process. If an alternative requires that all plans must include plan components to maintain or restore water quality, it can be expected that all plans revised under that alternative would include plan components designed to meet this requirement. If an alternative requires only consideration of water quality while conducting other management activities, or is silent on the issue, then there is less certainty as to whether plans will include plan components designed to maintain or restore riparian areas. There is a greater range of potential outcomes under such alternatives that under alternatives that include specific requirements.

Effects on Resources Expressed as General Outcomes Over Time

These types of effects are based on assumptions regarding effects on resources as plans revised or amended under each of the alternatives are implemented. These effects would be manifested over time, as the rule guides revisions or amendment of existing land

management plans or development of any new plans, and then as projects and activities implement the revised plans. Many factors will influence where and when these activities will occur, including the rate of plan revision, rate of implementation of revised plans, changing policies, and budget constraints or shifts in management priorities during implementation. Additionally the effectiveness of plan implementation will be greatly influenced by many factors including, but not limited to, the current condition and high degree of variability across NFS lands, changing conditions, activities occurring off NFS lands, intensity and occurrence of natural disturbances, invasive species, insect and disease outbreaks, and changing resource demands from an expanding population.

Some of the topics in this chapter do not lend themselves to this two-part description due to the nature of their effects analysis. Those sections that differ from this two-part description will be identified prior to the discussion of alternative effects, and include Multiple Uses, Transparency and Collaboration, Efficiency and Effectiveness, and Coordination and Cooperation Beyond NFS Boundaries.

Dynamic Nature of Ecosystems

The following discussions serve as a brief scientific overview of some of the ecological concepts discussed in the Climate Change, Ecosystem Restoration, Watershed Protection, and Diversity of Plant and Animal Communities sections that follow. They provide additional background and context for understanding and evaluating the alternatives for these issues. These discussions are not meant to be an in-depth treatment of these concepts; rather, they are intended to provide the reader with a basic understanding of ecological systems, how they function, and what influences them. A common understanding of these ecological concepts is useful for evaluating the scientific underpinnings of the proposed approaches to conserving and managing natural resources on National Forest System lands.

Forests and grasslands are dynamic mixtures of ecosystems at a variety of scales that vary in terms of their structure, composition, and functions over space and time. Each ecosystem is a response to numerous environmental and biological factors that interact and act upon organisms to affect ecological processes at multiple spatial and temporal scales, successional trajectories, and landscape patterns (Sharik et al. 2010). Understanding and conserving these complex and dynamic ecosystems presents a challenge, particularly as environmental stresses intensify with projected changes in climate (Hobbs et al. 2010).

An *ecosystem* is a biological environment consisting of all the organisms living in a particular area, as well as all the nonliving, physical components of the environment with which the organisms interact, such as air, soil, water, and sunlight (Campbell et al. 2009). Delimiting individual ecosystems on the ground can be a difficult and somewhat arbitrary exercise. However, there are distinct patterns to the distributions of organisms across various physical environments, and attempts to define ecosystems help organize our understanding of these patterns (Hunter 1999).

Ecosystems can be viewed at multiple spatial and temporal scales. Aquatic and terrestrial ecosystems are integrated and interdependent, and they change because of environmental

interactions, which vary across time and space. Describing and understanding the dynamics of ecosystems will require matching multi-scale monitoring and research if the Forest Service is to effectively manage natural resources in the face of shifting climate and disturbance regimes.

Early concepts of ecosystem dynamics assumed that following a disturbance event, an ecosystem underwent a succession of seral stages that followed a deterministic pathway to a steady-state endpoint, the climax community. Ecology now recognizes ecosystems as dynamic, open systems where the transitions among states is not fixed but subject to change due to disturbance regimes and other natural processes. These dynamics result in differing proportions of ecosystem states (that is, successional stages) of varying composition and structure within the natural range of variability of these ecosystems.

The *biological diversity* associated with ecosystems can be defined as the variety of living organisms; the ways in which they organize themselves (genes, species, populations, communities, and ecosystems); and the ways in which they interact with the physical environment and each other (Redford and Richter 1999). In order to maintain biodiversity at any level, it is essential to understand the compositional, structural, and functional components of ecosystems (Baydack et al. 1999). Noss (1990) provides a conceptual model of how these components interact at different levels of biological organization from genes to landscapes (Fig. 2). These components interact to maintain biological diversity.

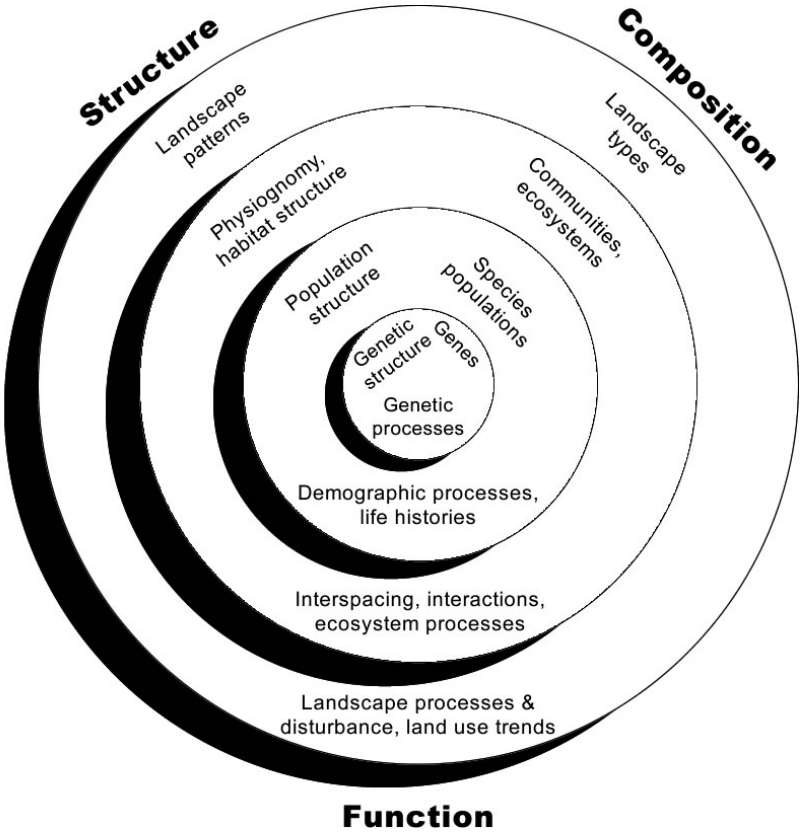

Figure 2. The Three Components of Biodiversity.

Adapted from Noss 1990.

Ecosystem *composition* refers to the biological elements within the different levels of biological organization, from genes and species to communities and ecosystems. *Structure* refers to how these biological elements are organized or physically arranged, such as down woody debris, landscape pattern and connectivity, vegetation layering, and snags. *Function* refers to ecological processes—such as energy flow; nutrient cycling and retention; soil development and retention; predation and herbivory; and natural disturbances such as wind, fire, and floods—that sustain composition and structure (Groves 2003). These three components (structure, composition, and function) of ecosystems are interdependent and must be considered together when trying to understand and anticipate how ecosystems will change over time. For this reason, the mechanisms that sustain the diversity of life within ecosystems are extremely complex, and our full understanding of them is still unfolding.

Based on increased understanding of historical ecology, ecologists have begun to appreciate the dominant role that natural disturbances and biological legacies play in influencing the structural and compositional development of vegetation in post-disturbance stands (White and Jentsch 2001, Franklin et al. 2002, Jackson et al. 2009) and the complex patterns that manifest across landscapes (Pickett and Thompson 1978, Pickett and White 1986). Patterns we observe as a result of ecological disturbance depend on the characteristics of disturbance (such as frequency, intensity, and extent) and the spatial and temporal grain and extent of observation (Wiens 1989, Turner et al. 1993, Shugart 2005).

A basic understanding of the importance of disturbance in determining the current and future characteristics of ecosystems has resulted in a focus on ecological disturbance in land management planning and evaluation. Managers realize that understanding historical disturbance processes at a range of spatial and temporal scales provides the foundation for building models (both descriptive and quantitative) to aid in predicting the ecological outcomes of both natural and human induced disturbances. Just as spatial ecology changed the perception of ecosystem dynamics from a focus on small quadrants and ‘stands’ to watersheds and drainage basins, so historical ecology has altered perceptions to focus on temporal dynamics (for example, disturbance processes) at a range of temporal scales. Without the perspective developed from historical ecology, understanding disturbance processes would not be possible. It will be essential for land managers to recognize the importance of using historical landscape dynamics as reference conditions for maintaining important landscape characteristics while evaluating whether current management will be within acceptable and feasible bounds for potential future landscape conditions (Keane et al. 2009). Furthermore, land management practices that attempt to emulate natural ecological processes are regarded by many scientists as more likely to perpetuate the ecosystem functions of managed areas (North and Keeton 2008, Seymour et al. 2002).

Acknowledging the dynamic nature of ecosystems and the importance of temporal scale in observed dynamics has lead to the further understanding that few systems are expected to remain relatively unchanged (that is, stationary) when viewed over the long term (Milly et al. 2008). The realization that ecosystems are non-stationary, and therefore

dynamic, does not render historical ecology unimportant; rather, it changes the nature of how it is used in resource planning. Much can be predicted about potential future landscapes by applying what we've learned from historical landscapes. A synthetic understanding of past dynamics provides the foundation for predicting system dynamics in the future.

Inherent Capability of the Land

The inherent capability of the land represents the ecological capacity or ecological potential of an area to express a defined range of biophysical conditions within ecosystems. The inter-relationship between the physical components of an area, its climatic regime, and the natural disturbances that have occurred throughout its ecological history help to define the range of ecological conditions (including plant and animal diversity) that persisted in that area over time. For land management purposes, it is important to recognize, classify, and map landscapes with different biological and physical potentials.

Ecosystems are defined by interactions of biological and physical systems. Comprehending these complex systems requires integrating knowledge concerning myriad physical and biological conditions and processes that form ecosystems. The structure and function of ecosystems are largely regulated along energy, moisture, nutrient, and disturbance gradients. Those gradients are strongly influenced by climatic, physiographic, hydrologic, and edaphic (pertaining to soil) factors, which vary at different spatial scales. For example, the biophysical conditions in the western Great Lakes area that provide for red and white pine forests will not currently accommodate longleaf pine forests, and vice versa.

A multi-scaled hierarchical approach is useful in understanding ecosystems. Ecological units are classified to identify areas that exhibit similar patterns in: potential natural communities, soils, hydrologic function, landform and topography, lithology, climate, and natural processes (such as nutrient cycling, productivity, and succession), and natural disturbance regimes (for example those associated with flooding, wind, or fire). Delimiting ecological units on the landscape assists in evaluating the inherent capabilities of land and water resources and the effects of management on them. Climate, as modified by topography, is a dominant factor defining ecological unit boundaries at upper (coarse-scale) levels of a classification hierarchy. Other factors, such as geomorphic process, soils, and potential natural communities, take on equal or greater importance than climate at lower (fine-scale) levels.

Changes to climatic conditions have been occurring through time. As climate has changed in the past, plant assemblages have re-sorted themselves into new associations (Delcourt and Delcourt 1988, Webb et al. 2003). With expected changes in climate, current climatic envelopes are expected to expand, contract, change, or completely go away, and new ones may form (Williams and Jackson 2007). Under these conditions, the climate component of some or many ecological units could change, causing the ecological conditions associated with these units to change, shift geographically, or completely disappear from the landscape. Thus, the inherent capability of those particular areas will also shift or change. As a result, species distributions and ecological processes

will change as the climatic envelopes change spatially (by location and extent) over time. Some species might be unable to adjust to drift in their climate envelope because of limited dispersal capability or strong associations with site-specific conditions (such as unique surficial geology and soils [e.g., serpentine soils]) that will not move.

Historical Range of Variability as a Way of Understanding the Historical Nature of Ecosystems and Their Variation

The *historical range of variability* (HRV) describes the variation in physical and biological conditions exhibited by ecosystems as a consequence of climatic fluctuations and disturbance regimes. Historical range of variability is a useful tool for understanding past ecological processes and the resulting biological diversity that persisted under those conditions (Morgan et al. 1994). The application of HRV assessments as an approach to define a range of ecological conditions that maintain biological diversity over large landscapes is based upon the common-sense notion that the environmental conditions most likely to conserve native species are those which sustained them in the past (Committee of Scientists 1999), and that by restoring and maintaining landscape conditions within distributions that supported native organisms over evolutionary time is the management approach most likely to maintain sustainable ecosystems (Manley et al. 1995). An understanding of HRV is derived from an assessment or evaluation of the ecological history of a landscape and is estimated from the rate and extent of change in selected physical and biological variables. Application of HRV to land management varies depending on the extent of ecological understanding of specific systems and the objectives of resource management. In the most general sense, an HRV assessment for most ecosystems represents a significant scientific evaluation of multiple ecosystem characteristics. This understanding of temporal dynamics provides context for land management planning, analysis of potential effects of management actions, and development of temporally relevant monitoring schemes.

Under certain circumstances, HRV represents a characterization of desired range of ecological conditions to guide restoration efforts based on the concept that the environmental conditions that sustained species and other system components in the past are likely to sustain them, at least over the short term, in the future. The use of HRV as a reference condition carries the uncertainty associated with trying to find historical time periods that remain analogous to present and future conditions in the context of global change. For example, many future climate projections for the Western U.S. indicate tendencies towards earlier spring snowmelt, and warmer and drier summers with additional days of low relative humidity. These conditions are likely to lead to extended fire seasons with a greater frequency of large, high-intensity forest fires (Brown et al. 2004, Keeton et al. 2007, McKenzie et al. 2004, Westerling et al. 2006).

However, the HRV concept can be used for much more than restoration of past conditions. HRV can be a fundamental tool in strategic thinking and planning, even where restoration to historical conditions is not the management goal. Just as landscape ecology provides the foundation for considering the consequences of spatial patterning on ecosystems, HRV assessments provide the ecological understanding of temporal dynamics of systems and its consequences for management.

In a world of changing climate, however, this premise must be carefully applied given an understanding of the specific geographic location under consideration, its existing ecological conditions, and projections of various climate regimes that might characterize the area in the future. Under future climate conditions, ecosystem characteristics within HRV might not be sustainable as the system reacts to novel climatic events.

The HRV of areas in the Western United States has been used in the development of management goals in Federal and State management plans (FEMAT 1993, Oregon Department of Forestry 2001), and appear to be effective at evaluating whether trends are within or moving away from historical ranges and at evaluating differences among management alternatives for maintaining conditions within historical ranges (Nonaka and Spies 2005).

Although HRV assessments can help explain the processes that contributed to current spatial and temporal patterns of ecosystems (Cissel et al. 1999), there are limitations in their application. Data quality varies regarding ecological characteristics across domains of temporal scales. Where data quality is sufficient and when done well, these assessments highlight the importance of past climate change in patterns of ecosystem change at a range of spatial scales, facilitating evaluation of the potential directions of ecological change under a variety of future climate scenarios. Lingering climatic effects must be recognized because they are a potentially confounding factor in assessing HRV conditions (Millar and Woolfenden 1999). For example, tree recruitment for many species in semiarid areas is especially sensitive to climate, so old-growth forests today might have developed under different climates (Graumlich and Lloyd 1996), such as existed during the Little Ice Age. Millar and Woolfenden (1999) suggest that managers should use the HRV information to understand what kinds of changes have occurred and how ecosystems have responded to those changes. Nevertheless, they note that "because forests are in constant movement through time, we cannot hope to manage sustainably without understanding and working with these environmental trends." Data availability for reconstructing a disturbance history for some areas may make completing a HRV assessment more difficult, such as in the Eastern United States where land-use history is a much more important concept to consider than it is in many areas of the West.

Keeton (2007) summarizes the HRV concept as follows:

> An implicit assumption in these approaches is that forest management will be ecologically sustainable—i.e., has greater likelihood of providing viable habitats for a full range of native species—if it maintains or approximates ecosystem patterns and processes associated with natural disturbance regimes and successional processes (Aplet and Keeton 1999). This bounded range within which attributes of ecosystem structure and function vary over time and space has been termed the 'historic range of variability' (HRV). According to this line of thinking, if HRV represents the conditions under which organisms evolved and have adapted, then species will have the greatest likelihood of survival if similar conditions are provided through management. There are examples of forest management plans based on reconstructions of HRV (e.g., Cissel et al. 1999, Moore et al. 1999). Yet HRV-based approaches are difficult to

> implement. To begin with, the feasibility of quantifying HRV for a given landscape varies greatly depending on data availability and modeling requirements (Parsons et al. 1999). There is the added difficulty of finding appropriate historical reference periods (Millar and Woolfenden 1999). Thirdly, forest managers must determine whether HRV offers a realistic target for management, considering the extent to which conditions within the HRV are compatible with contemporary management objectives, altered ecosystem conditions and dynamics attributable to land use history, and changing climatic conditions. Despite these limitations, HRV provides an informative benchmark or reference for understanding landscape change (Aplet and Keeton 1999).

Ecological Integrity and Resilience

The concept of ecological integrity is complex and related to many other terms, such as ecosystem resilience, resistance, and stability. *Ecological integrity* is

> the ability of an ecological system to support and maintain a community of organisms that has a species composition, diversity, and functional organization comparable to those of natural habitats within a region. An ecological system has integrity, or a species population is viable, when its dominant ecological characteristics (e.g., elements of composition, structure, function, and ecological processes) occur within their natural ranges of variation and can withstand and recover from most perturbations imposed by natural environmental dynamics or human disruptions (Parrish et al. 2003).

Ecosystems with greater ecological integrity will be more resistant and resilient to the effects of changing patterns and types of disturbance (Parrish et al. 2003).

Resilience is generally defined as the capacity of an ecosystem to absorb disturbance and return to the pre-disturbance state so as to retain the same function, structure, identity, and feedbacks (Holling 1973). This definition of resilience incorporates the dynamic nature of ecosystems and contrasts with earlier definitions of resilience that regarded ecosystem states as static. Resilience is an emergent property of ecosystems that is conferred at multiple scales by genes, species, and processes within the system (Gunderson 2000, Drever et al. 2006). As ecosystems change under cumulative or sudden stress, their resilience might be overcome, resulting in a new ecological state that has a different structure or composition. In this case, the concept of resilience can be extended to include the adaptive capacity of the system to minimize loss of its function, structure, and composition. Resilient forest ecosystems tend to be relatively stable, with the capacity to maintain a dynamic equilibrium while resisting change even under changing conditions (Diaz and Cabido 2001).

The collective biological diversity and combined biological activities of many species is one of the important factors that influence the functioning of ecosystems (Chapin et al. 1997, Naeem et al. 1999). Species composition matters because organisms drive ecological processes, and species differ in their biological traits (feeding, growing,

moving, excreting waste, etc.) and their subsequent ecological effects to ecosystems. The presence of certain species and the range of individual species traits present in an ecosystem influence species interactions and abundances, which influences population, community, and overall ecosystem processes. Additionally, greater species diversity increases the probability of including species that have strong ecosystem effects and increases the efficiency of resource use (Chapin et al. 1997, Tilman 1999). Factors that change ecosystem composition, such as invasions by nonnative species, nitrogen deposition, disturbance frequency, fragmentation, predator decimation, and species extinctions that, in turn, change functional diversity and functional composition, are likely to strongly affect ecosystem processes (Tilman et al. 1997).

Resilient ecosystems tend to exhibit high biological diversity (given the inherent capacity for a particular ecosystem to support different kinds of species) and can maintain ecosystem functionality after a disturbance through *functional redundancy*, in which ecosystem components that perform the same or similar functions in that system can replace those that are lost (Naeem 1998, Yachi and Loreau 1999). Diverse ecosystems tend to possess higher degrees of functional redundancy and have the ability to continue ecological functions (e.g., production) even when the species providing those functions change (e.g., Loreau 2000). Functional redundancy could occur at the species, population, or genetic levels, and greater diversity appears to be associated with greater stability in ecosystem processes (Hooper et al. 2005). Functional redundancy is important for long-term ecosystem persistence (Drever et al. 2006) because, when conditions change, even species that previously did not have obvious functional roles can become functionally dominant and thereby buffer the ecosystem against large changes (Walker 1995). As noted by Chapin et al. (1997), "The abundance of species with similar ecological effects provides resistance and resilience to ecosystems in the face of increasingly rapid human-induced environmental change." An example of functional redundancy occurred when the introduction of chestnut blight led to the decimation of American chestnut, a dominant tree species and important mast source of the southeastern forests of the United States. With the demise of chestnut, other species (such as oaks and hickories) attained greater prominence and continued to provide a source of food for a variety of animals.

Stressors and Their Influence

Various types of stress are threats to biodiversity. *Stressors* can be defined as a factor that directly or indirectly degrades or impairs ecosystem composition, structure or ecological process in a manner that impairs its ecological integrity, such as invasive species, loss of connectivity, or the disruption of a natural disturbance regime. For example, altered hydrological flows caused by irrigation withdrawals can lead to local extirpation of rare fish species; inappropriate grazing by domestic livestock in plant communities that evolved in the absence of substantial herbivory will alter the expected level of primary productivity and nutrient cycling; or the disruption of natural fire regimes on a ponderosa pine forest or tallgrass prairie can alter species composition and actually elevate the likelihood of uncharacteristic fire events. Stressors can range in scope and severity from relatively localized, such as a facility development near an active raptor nest, to extremely broad, such as the invasion of a nonnative annual grass species into a

sagebrush or grassland landscape. Stressor sources are the agents that generate the stresses, such as a dam, poorly maintained roads, fire suppression activities, forces contributing to forest fragmentation, or the introduction of an invasive species. Sources also vary in terms of the degree to which they contribute to a stress and the irreversibility of the impact of that stress on a species, a collection of species, or an ecosystem—from the permanent impairment of severe compaction or erosion on soil productivity, to stream sedimentation from a temporary road that can be decommissioned and rehabilitated, to prescribed burning that can be used to replicate the historical function of fire on the landscape (Groves 2003).

From a land management perspective, there are stressors to biological diversity that can be alleviated through natural resource management strategies and practices. Examples of these include: the use of prescribed fire to emulate natural fire regimes in fire-dependent ecosystems; the location, type, and maintenance of secondary road systems to eliminate the movement of sediments into nearby streams; tree harvest practices that restore the composition, structure, and pattern of forested stands; removal of dense understory and midstory tree conditions due to fire suppression to reduce the risks of large, stand-replacement fires in fire-prone landscapes; and altering domestic livestock grazing strategies to maintain or restore the composition or structure of grassland or shrubland ecosystems. There are also ecosystem stressors that are the result of actions or activities that are largely beyond the control of public land managers. Examples of these include: mercury contamination of aquatic ecosystems that comes from a variety sources; acid deposition that may cause significant stress to lakes, streams, and forest ecosystems, especially to those at higher elevations; large hydropower facilities that may obstruct anadromous fish passage to upstream spawning areas; changes to vegetation conditions in Central and South America that may affect wintering populations of migratory birds that breed and nest in North America; and potentially dramatic changes to ecological conditions due to global climate change.

Today, there is greater appreciation for climate uncertainty and its potential effects on ecosystems. Climate change exacerbates the influence of other stressors, and cumulatively threatens to push ecosystems into fundamentally different ecological states by adding more pressure on their ability to sustain native plant and animal diversity. Climate change creates new combinations of stresses, and forest and grassland responses to these stresses might be unique and unexpected (McNulty and Boggs 2010). Environmental changes are occurring, adding to the complexity of understanding ecosystem dynamics and the difficulty in predicting the stability of native species or processes in the face of natural or anthropogenic (human-influenced) disturbance. Climate change is predicted to result in novel, unprecedented future weather patterns, so efforts to restore forests or grasslands based solely on past conditions might result in ill-adapted and vulnerable rather than resilient ecosystems (Millar et al. 2007). Current and predicted changes in temperature and moisture regimes and increasingly frequent extreme events have the potential to directly affect species, communities, and ecosystems. Climate-dependent characteristics of an ecoregion include averages and variability of temperature, precipitation, diurnal and seasonal temperature range, actual and potential evapotranspiration, and growing season length; as well as the severity, extent, and intensity of extreme disturbance events. These characteristics will be dramatically

affected by the enhanced greenhouse effect on time scales, ranging from decades to a few centuries (Groves 2003).

The effects of climate change will vary across the country based on the direction, magnitude, and rate of climate change, and the interactions of these changes with physical and biological systems. Current science points to increased vulnerabilities to climate related stresses where species occur at the margins of their tolerance ranges or competitiveness (Beckage et al. 2008). Species' vulnerability to climate change is determined by their exposure to climate change, their sensitivity to this change, and the adaptive capacity of the species. Ecosystem vulnerability depends on a suite of interactions that directly or indirectly affect species and communities and include changes in important processes, such as insect and disease outbreaks, fire, and hydrologic regimes. Effects will also vary due to other modifying factors, including topography and physical substrates, landscape patterns affecting species' dispersal or isolation, fire potential, community successional dynamics, and the physiology of species themselves.

At this time, there is a great deal of uncertainty in climate change projections. More specifically, the U.S. Global Climate Change Research Program has noted,

> For some aspects of climate, virtually all models, as well as other lines of evidence, agree on the types of changes to be expected. For example, all climate models suggest that the climate is going to get warmer, the heat index is going to rise, and precipitation is more likely to come in heavy and extreme events. This consistency lends confidence to these results. For some other aspects of climate, however, the model results differ greatly. For example, some models project more extensive and frequent drought in the U.S., while others do not. The Canadian model suggests a drier Southeast in the 21st century while the Hadley model suggests a wetter one. In such cases, the scenarios provide two plausible but different alternatives.
> (http://www.globalchange.gov/component/content/article/338)

The current relationship between a species' actual and potential environmental niche, its physiological and behavioral adaptability, its ability to disperse, and its ability to compete with other species and colonize unfamiliar habitats are poorly understood. Because we cannot predict many aspects of future climate, short-term actions intended to maintain or restore ecological integrity so as to enhance the resistance and resilience of ecosystems should include maintaining as many elements of ecosystems and ecological options as practical. Aquatic and terrestrial ecosystems with greater ecological integrity will be more resistant and resilient to the effects of changing patterns and types of disturbances (Parrish et al. 2003). Ultimately, reducing current stressors and increasing the buffering capacity and resilience of ecosystems through practices that maintain or restore ecological integrity is warranted. Applying our understanding of historical and current ecosystem dynamics will provide insight into what the responses of ecosystems to future climates might be. One approach is to maintain, conserve, or restore areas with natural land cover because all future natural areas (on a time scale of decades to centuries) must be some subset of the current ones. This approach takes into account the near-term

implications of long-term trends and the need to be suitably prepared for increased climate variability (Groves 2003).

Public lands face rapid environmental change, such as those resulting from climate change, unprecedented spread of invasive species, and emerging pathogens. These threats, coupled with the dynamic nature of ecological systems, create considerable environmental uncertainty related to the efficacy of attaining conservation goals reflected in land management plans. However, land management actions may also directly influence the likelihood and magnitude of how problems related to these environmental changes and other dynamic forces will be manifested on the landscape. Land management planning is not only constrained by these dynamic forces but may also shape their manifestation on public lands.

Management in the Face of Uncertainty

Forests and grasslands are dynamic and complex systems that vary over space and time in response to environmental conditions. This environmental variation induces stochasticity (randomness) in biological and ecological processes, and can lead to unpredictability in how the systems behave. Biophysical, social, and operational sources of uncertainty can combine and build on each other to make natural resource management challenging (Allan et al. 2008). Overlaying those sources of uncertainty are complexity and uncertainty in social political, institutional, and economic systems.

Nevertheless, resource management requires that planning decisions be made even under conditions of great uncertainty and complexity. Decisions are often needed even when there is incomplete information, in part because lack of action may produce less desirable outcomes. High uncertainty raises questions about how well future conditions can be predicted, and whether one management approach can be known to achieve an objective better than another. In addition to being able to make decisions when there is insufficient information to know the best way forward, planners and managers must be able to adapt as new uncertainties reveal themselves, changes happen, and surprises emerge. Although effective management of these systems may be limited by uncertainty about the processes and the influences of management actions on them, managers often do not have the luxury of waiting until better information is in hand. One way to improve success in meeting management objectives is to reduce uncertainty and adjust the way forward as information is gathered.

A key issue in reducing uncertainty involves characterizing and accounting for it (Bormann and Kiester 2004). Williams (2011) listed four kinds of uncertainty that can influence the management of natural resources: environmental variation, partial observability about a resource (sampling variation), partial controllability of management implementation, and structural or process uncertainty that concerns a lack of understanding about the relationships that drive resource dynamics. Williams noted that environmental uncertainty can be captured in contrasting hypotheses imbedded in different forecasts of how the resources will change over time. As evidence accumulates through monitoring of the resource, confidence placed in each forecast and its associated hypothesis can evolve.

This iterative process of learning is called active or science-based adaptive management (Williams et al. 2009). Decisionmaking involves the active pursuit of learning, either through experimental management that focuses directly on learning, or quasi-experimental management that focuses simultaneously on learning and achieving management objectives. Monitoring focuses on resource status as well as other system attributes needed to improve understanding through time, and assessment produces estimates of resource attributes that can be used for learning. Active, science-based adaptive management is the approach preferred by the science community (Schultz 2008) and has been adopted by the Department of the Interior (Williams et al. 2009). This approach can be considered "learning by doing" because policies and plans can evolve as results of actions are evaluated and thus more information becomes available. The active approach was developed in the 1970s in response to concerns over the effects of people on ecosystems and with the realization that ecological research alone was unlikely to improve the way natural resources were managed. The approach consists of an integration of environmental, economic, and social issues in the development of policy and management strategies, and an interactive cycle of experiences in applying environmental policy that contributes to refinement of the policy (Holling 1978). Later, quantitative modeling based on existing information and stakeholder collaboration were recognized as important components in the process of identifying management alternatives before implementation (Walters 1986). Walters and Holling (1990) advanced the use of competing hypotheses about impacts of management alternatives on ecosystems to develop management experiments to test the hypotheses. Now adaptive management is seen as effective at evaluating the potential risk related to many issues simultaneously in complex systems where there is inadequate information about the best management option.

Lee (1993) examined the broad societal implications of collaborative, active adaptive management, including the benefits of societal learning. Kusel et al. (1996) noted that adaptive management relies on a collaborative effort among managers, scientists, and the public, and this requires a fundamental change in the relationships among these participants to one where mutual trust can lead to participatory decisionmaking. Shindler et al. (1996) recognized the need for a new decisionmaking framework that incorporates both scientific principles and public collaboration at the local community level.

The most ambitious, large-scale, and lengthiest application of adaptive management in the Forest Service has been the Northwest Forest Plan. The plan and record of decision were written to amend previous forest plans to manage 24 million acres of Federal lands in the range of the northern spotted owl. Given a finding of high uncertainty, the adaptive management strategy was viewed as a cornerstone for the entire plan (Stankey et al. 2003). The strategy had four major elements: (1) a place for the strategy to be used (the adaptive management areas), (2) organizational strategies to apply the adaptive management process across the entire plan area, (3) a major regional monitoring program, and (4) a formal interpretive step that gathered what was learned and translated new understandings for decisionmakers to use.

Haynes et al. (2006) evaluated the first 10 years of implementation of the Northwest Forest Plan and concluded that the formal interpretive step was a successful closing of an

adaptive management loop because it helped illuminate and integrate disparate disciplinary information into findings that were then adopted by regional executives.

ECOSYSTEM RESTORATION

Affected Environment

The Society for Ecological Restoration defines ecosystem restoration as "the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed" (Society for Ecological Restoration International Science & Policy Working Group 2004). Ecological restoration focuses on reestablishing the composition, structure, pattern, and ecological processes necessary to facilitate terrestrial and aquatic ecosystem sustainability, resilience, and health under current and future conditions.

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 removing problematic chronic and pulse stressors while facilitating disturbance, species movement, and system development necessary for ecological composition, structure, and process associated with the desired system to resume. A restored ecosystem should be able to sustain itself indefinitely with minimal intervention when natural disturbance patterns are present. In some cases active management may be required, such as simulated flood events or prescribed 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 exchanges, abiotic flows, and cultural settings (USDA Forest Service 2006d).

As described, restoration may appear to be a backward-looking process. In large part, this is because past conditions incorporate most of what we know about the composition and workings of natural ecosystems. Restoration inherently implies some knowledge of species occurring in a system and how they functioned (Foster 1998). 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."

One method to determine the deviation of current ecosystem states from targets defined by historical knowledge of system dynamics is to compare ecological conditions within terrestrial and aquatic ecosystems to their historical range of variability (Landres 1999). (See Historical Range of Variability as a Way of Understanding the Historical Nature of Ecosystems and Their Variation in the Dynamic Natural of Ecosystems section of this chapter). As a consequence of climate change, invasive species, extinctions, and social or economic factors, predictions regarding ecological trajectories will be quite uncertain. Therefore, reference ecosystems are unlikely to represent appropriate targets or goals for restoration (USDA Forest Service 2006d). For further discussion see the previous section on Historical Range of Variability section, cited in this paragraph.

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 (USDA Forest Service 2006d).

Humans have been altering North American ecosystems for thousands of years. Native Americans influenced ecosystems through a wide range of activities including harvest of plant materials and animals, tilling the soil for agriculture, and igniting fires to accomplish a wide range of cultural activities. Extensive timber harvest, often resulting in complete clearing of forests for agriculture at the turn of the 19th century, dramatically altered vegetation composition and ultimately the age classes and species composition of forests, particularly in the Eastern United States. The effects of sluice damming for transporting of logs and channelization of rivers for transportation of people and goods are evident today. Railroads opened large expanses of the West to settlement. Unregulated market and sport hunting decimated populations of wide-ranging herbivores, changing grassland composition and function. Acts that established Forest Reserves and National Parks and withdrew the public lands from disposal provided for millions of acres of public lands that today range from largely undeveloped areas to wilderness areas. Continued urbanization (and more recently suburban and exurban development) and its increased demands for goods and services, along with forest and grassland fragmentation, spread of invasive species, acid rain deposition, and changing climate continue to alter ecosystems on and off NFS lands. A stressor is generally associated with a departure from a reference condition that is primarily based upon the historical range of variability (see the section on Historical Range of Variability as a Way of Understanding the Historical Nature of Ecosystems and their Variation and the section on Ecological Integrity and Resilience in this chapter). Past and current human-induced stressors on NFS lands have resulted in changes to aquatic and terrestrial systems that, in some cases, impair ecological integrity and diminish resilience.

Not all human-caused changes to ecosystems should be considered stressors. Many recent management activities that result in changes to current ecological conditions could be considered restorative. Additionally, the extent and severity of a particular type of stressor vary considerably depending on its location and ecological context (see previous section on Ecological Integrity and Resilience).

The following section provides examples of the stressors existing on NFS lands, along with a brief overview of stressors, sources of stressors, and potential effects on:

- Aquatic resources,
- Terrestrial vegetation composition and structure,
- Landscape patterns and habitat connectivity,
- Natural fire regimes, and
- Species interactions.

Stressors That Alter Aquatic Resources

Ninety-seven percent of NFS watersheds are considered healthy or relatively healthy (watershed condition class 1 or 2). The remaining 3 percent have impaired function and may require substantial investment to restore watershed conditions (see Watershed Protection section).

The stressors leading to damaged or degraded watersheds include dams, water withdrawals, and vegetation removals (timber harvest or grazing) in the uplands that alter hydrologic flow patterns and channel stability. Sediment from roads or mass wasting events enters streams, changes sediment regimes, and increases water temperatures. Past channelization of streams and rivers, roads in floodplains, beaver removal, invasive species, past log and tie drives, and small dams for mills on Eastern streams have simplified stream structure and hydrologic function. Water-related recreation can change riparian vegetation structure and affect shoreline stability. Wetlands filled for development of infrastructure results in reduced storage and filtering capacity of watersheds. The potential effects of these stressors include reductions in aquatic habitat quality and quantity, increased costs for drinking water supplies, and increased risk of floods.

Stressors That Alter Vegetation Composition and Structure

Alterations to forest, shrubland, and grassland vegetation composition, structure, and pattern on NFS lands have been occurring over the past several centuries. Historical land use prior to the establishment of national forests and grasslands, especially in the Eastern United States, has influenced species composition and structure for very long periods of time, and may continue to do so. The legacies of historical, wide-spread logging, grazing, and agriculture can have long-term, lingering effects on plant and animal diversity, even after vegetation has regrown (Rhemtulla et al. 2009).

Vegetation structure and composition affect ecosystems through provisioning of resources such as food or substrate, altering light environments and microclimates in the forest understory through their crown characteristics, and affecting ecosystem processes such as nutrient cycling and disturbance regimes. Changes to vegetation composition, either through natural processes or management activities, will affect the type, number, and abundance of other species. Vegetation management activities that alter successional pathways, especially by homogenizing species composition, can change the collection of plants and animals that persist in ecosystems and ultimately erode the resilience of those ecosystems (Drever et al. 2006). Species that are already rare are especially prone to being lost from the assemblage since the specialized habitats they depend on are often lost from highly modified systems (Palik and Engstrom 1999).

Changes to the amounts and configurations of landscape structural characteristics, such as patch size and edge length, as a result of management activities can produce dramatic effects on natural disturbances and species diversity in forest ecosystems (Franklin and Foreman 1987). Some of these alterations are directly attributable to past tree regeneration harvests and planting practices such as the conversion of longleaf pine stands to loblolly pine, or intermediate harvests such as pine thinnings to improve tree

vigor and growth resulting in changes to understory composition and development. Tree harvesting practices have also altered the distribution of forest patch sizes and changed the amount of interface (edge) between early seral and late seral forest conditions.

So too, domestic livestock grazing in some areas has altered the tree and shrub character of grassland riparian areas associated with small upland streams. Some livestock grazing practices have changed mixed-grass prairies dominated by cool-season grasses such as green needlegrass and western wheatgrass, to shortgrass communities dominated by warm-season grasses such as buffalograss and blue grama. Other alterations in forest and grassland vegetation composition, structure, and pattern are an indirect result of past management activities, such as fire suppression in fire-adapted ecosystems resulting in changes to vegetation composition, structure, and pattern. For example, some ponderosa pine forests in the intermountain region now include large amounts of Douglas-fir and true firs in denser stands (Mutch et al. 1993). Additionally, fire suppression in forests with a history of low-intensity fires can shift the structure of these forests from an open canopied structure to a dense, multi-storied structure. Examples of these fire adapted forests include longleaf pine in the Southeast and ponderosa pine in the West.

Cumulatively, these alterations in vegetation composition, structure, and pattern have resulted in substantial changes to habitat conditions and suitability for a wide variety of forest and grassland plant and animal species, both terrestrial and aquatic. The abundance and distribution of plant and animal species associated with the specific vegetation communities affected by these alterations have thus been reduced. Classic examples in forested systems are the northern spotted owl, dependent on old-forest communities of the Pacific Northwest (Bart and Foresman 1992), and Kirtland's warbler, dependent on young forest conditions in northern Michigan (Probst and Weinrich 1993). In grassland systems, fire suppression and attendant woody encroachment has degraded habitat for such species as sage grouse (Crawford et al. 2004) and lesser prairie-chicken (Hagen et al. 2004).

Stressors That Alter Landscape Patterns and Habitat Connectivity

From a biological diversity perspective, functional habitat connectivity is provided when ecological conditions exist at several spatial and temporal scales that provide for the movement and population interchange of species. Functional connectivity provides landscape linkages that permit daily and seasonal movements of animals within home ranges, facilitate dispersal and genetic interchange between populations, and allow long-distance range shifts of species, such as in response to climate change (Noss and Cooperrider 1994).

Aquatic and terrestrial landscape patterns have been substantially altered, reducing or eliminating ecological connectivity for some organisms. Loss of connectivity within aquatic habitats can result from physical barriers such as dams or poorly positioned or undersized culverts. Degraded within-stream habitat conditions or alterations in water quality due to changes in temperature, sediment loading, or chemistry along stream reaches can make these reaches less permeable to certain aquatic organisms. Within terrestrial habitats, loss of connectivity between various habitat components or patches of habitat can be the result of physical barriers such as roads, highways, and other

permanent developments, or permanent loss of native vegetation through conversion of forest or grassland to other land uses. Alteration of vegetation characteristics can make critical areas for movement, such as along riparian areas or within saddles between mountains, less permeable to some species.

The loss of landscape permeability at a variety of scales can result in the disruption or elimination of many important ecological functions, especially those related to population dynamics, such as: the transfer of genetic material among populations; the ability for individual species or breeding pairs to carry out critical life cycle or biological requirements within a particular home range (breeding areas, spawning areas, wintering areas, foraging areas); dispersal; and migration.

Stressors That Alter Natural (Historical) Fire Regimes

Recurring fires, both stand-replacement events and stand-maintenance ground fires, have been a major disturbance process shaping vegetation composition, structure, and patterns at multiple scales on many landscapes. Fires in the longleaf pine ecosystem, for example, favor the persistence of longleaf pine and are fueled primarily by highly pyrogenic (producing or produced by heat) longleaf pine needles (Ware et al. 1993). Fire-caused mortality of some longleaf pine seedlings and small saplings maintains an open canopy structure with few hardwoods in the midstory or overstory (Platt et al. 1988). This results in an ecosystem with a very high species richness of herbaceous and shrub species exceeding any yet reported for temperate ecosystems in the western hemisphere (Peet and Allard 1996). Altering the seasonality, frequency, and intensity of burning favors different suites of species (Walker and Peet 1983). Thus, a fire regime that shifts overstory composition from longleaf pine toward more hardwoods has a dramatic and conspicuous negative impact on the native species characteristic of this ecosystem. Additionally, management actions that convert longleaf pine stands to loblolly pine or slash pine, whose seedlings are much more sensitive to fire than longleaf pine, will change the fire frequency, which will alter plant and animal composition (Palik and Engstrom 1999). These ecosystem changes can have dramatic effects on rare species such as red-cockaded woodpecker and gopher tortoise, and on rare communities such as pitcher plant bogs. Other examples of forest ecosystems that were shaped by relatively frequent, low-intensity maintenance fires include ponderosa pine forests in the Western United States, oak-savanna forests in the central United States, and hardwood-conifer forests of the central Appalachians. Stand-replacement fire events were a dominant ecological force in some North American forests, such as jack pine forests in the upper Midwest and lodgepole pine forests of the central and northern Rockies. Similarly, fire played an important role in shaping the composition and structure of native grassland and shrubland ecosystems, where periodic fire prevented woody encroachment and alteration of open-land habitats.

Active fire suppression over the past several decades has disrupted, minimized, or eliminated this important ecological process on many national forest and grassland units. Loss of natural fire regimes in fire-adapted ecosystems fundamentally alters ecological conditions, key ecosystem components, and important vegetation characteristics. Additionally, altered natural fire regimes can lead to changes in fuel loading, composition

and arrangement, and fire behavior. This is expected to lead to increased vulnerability to, and frequency of, disturbances such as stand-replacement fires and widespread insect and disease outbreaks or other stressors such as widespread invasions of nonnative species.

Stressors That Alter Species Interactions (Associated with the Spread of Invasive Species and Increased Incidence and Extent of Insect and Disease Outbreaks)

Invasive species have produced dramatic changes to forest and grassland ecosystems. Introduced pathogens such as Dutch elm disease and chestnut blight have decimated some native tree species. Introduced insects such as emerald ash borer and gypsy moth continue to alter the composition and structure of forested landscapes. Saltcedar and purple loosestrife are nonnative species affecting the ecological integrity of riparian and wetland ecosystems. Cheatgrass, Kentucky bluegrass, and spotted knapweed are doing the same in prairies, grasslands, shrublands, and meadows. Zebra mussels are displacing native species and disrupting aquatic food chains in many aquatic ecosystems. Two more recently introduced fungi, *Batrachochytrium dendrobatidis* or Chytrid fungus and *Geomyces destructans or* White-nose syndrome, are having devastating effects on amphibian and bat populations respectively. These are just a few examples of invasive species that either have in the past or are currently posing significant threats to species diversity in North America.

Invasive plants constitute 8 to 47 percent of the total flora of most States in the United States (Rejmanek and Randall 1994); approximately 4,500 exotic species in the United States have established naturalized populations and at least 15 percent of these cause severe harm (U.S. Congress, Office of Technology Assessment 1993). Threats and effects of invasive plant species are expected to increase in the next 20 to 50 years, challenging the Forest Service to address landscape, regional, and national issues of invasive species management and mitigation (Sieg et al. 2010). In addition, invasive species can affect efforts to restore imperiled native species, and are the United States' second leading cause of species endangerment after habitat destruction and degradation (Wilcove et al. 2000). Klepzig et al. (2010) notes that there is a need to increase our understanding of the invasion potential of non-indigenous species and the habitat characteristics that increase or decrease the ability for a new invader to establish in a community.

Native insects and diseases are species components of all native ecosystems and provide critical functions to maintaining the ecological integrity of those ecosystems. They add to the dynamic nature of ecosystems and for the most part are not considered to be an ecosystem stressor. However, more recently, the frequency and extent of insect and disease epidemics and their effects on ecosystems appear to have increased substantially. In some cases, these events could be following natural cycles that have not been observed in recorded history. In other cases, there is evidence that these outbreaks have been exacerbated by human-induced stressors such as changes to atmospheric conditions, climate, or ecological conditions. The USDA Forest Service (2008b) reported that relative to a reference condition established in the 2003 National Report on Sustainable Forests, there is a continuing and increasing trend in declining forest health and vitality.

Higher mortality of trees due to large-scale insect outbreaks (e.g., mountain pine beetles in the Western United States) has occurred in forests with high stand density, drought, and milder winter temperatures. Within the lower 48 states, the cumulative total forested area with mortality has increased from 12 million acres in 2003 to 37 million acres in 2010.

It is clear that the introductions of nonnative species to national forest and grassland ecosystems have had and are continuing to have profound effects on the ecological integrity of those systems at scales ranging from single sites to entire landscapes. They can affect the composition and structure of these ecosystems, and most importantly alter the processes necessary to maintain native plant and animal diversity.

Ecosystem Restoration in Current Plans

Analysis of plans recently reviewed under the 1982 planning provisions shows that the historical range of variability was evaluated and used to identify approaches to restoration in some of the recently revised plans. Some qualify their reliance on historical conditions by taking into account ongoing and anticipated disturbances such as climate change or invasive species encroachment. Most of these plans identify restoration as a tool to enhance the resiliency of ecosystems in response to stressors and disturbances. Some units focused explicitly on habitat restoration as a tool to support specific species resiliency or to create habitat linkages to facilitate movement and migration of species.

Vegetation management treatments along with the application of fire were often identified as tools for restoration in these revised plans. All of the recently revised plans reviewed include approaches for aquatic restoration such as restoration of riparian zones, adding large woody material to improve aquatic habitat, restoring stream banks, re-establishing beaver populations, adding structural complexity to artificially straightened stream reaches, and removal or replacement of culverts.

Most of these revised plans provide for the reduction or removal of stressors, such as controlling off-trail motorized recreation, controlling or eradicating invasive species, and altering grazing management practices in riparian areas.

Restoration Activities

Some ecosystem restoration objectives may be accomplished through passive management strategies, where no action or activity is needed, such as allowing forest succession to advance towards desired conditions or allowing natural revegetation of roads and trails that are no longer in use. Other restoration objectives will require active management strategies, such as prescribed burning to maintain or restore fire-adapted ecosystems. Still others will require actions to maintain or restore ecological conditions that are degraded, damaged, or destroyed.

A wide variety of active ecosystem restoration objectives have been and continue to be incorporated into land management plans and in subsequent projects. The following provides some examples of restoration activities focused on improving or supporting ecological integrity in those ecosystems:

- Removal and replacement of undersized or improperly placed culverts to allow passage of aquatic organisms, increase bank and channel stabilization downstream, and better facilitate periodic flood events. These activities are designed to increase connectivity, resilience, and resistance.
- Road decommissioning to reduce sediment levels in nearby streams or to provide improved upland habitat quality by reducing human disturbance. Road decommissioning is designed to improve ecosystem structure, habitat quality, and water quality.
- Removal of movement barriers, construction of wildlife crossing structures, or assisting animal movements to restore biotic exchanges among isolated habitats.
- Harvesting (off-site) loblolly pine stands in longleaf pine ecosystems to restore longleaf pine habitats for red-cockaded woodpecker and associated species. This activity is designed to restore forest composition and pattern and to improve habitat.
- Intermediate thinning harvest in a 60–80-year-old red pine plantation with a prescription for leaving a variable density of trees with small openings to encourage understory and midstory development. These activities are designed to improve stand composition and structure and habitat conditions.
- Precommercial thinning of densely spaced plantations or young conifer stands that are overly dense, due to fire exclusion. This activity is designed to improve stand structure and emulate ecological processes.
- Prescribed fire in fire-adapted ecosystems to maintain or restore forest or grassland composition and structure. This activity is designed to reinstate ecological processes and improve altered ecosystem composition, structure, and pattern.

The anticipated outcomes of activities that restore landscapes and enhance ecological integrity include:

- Functioning watersheds, with enhanced water quality and lower treatment costs for public water supplies.
- Productive ecosystems that yield goods and services, including ecosystem services, far into the future.
- Restoration-based work opportunities that have positive environmental impacts, enhance ecosystem services and values, yield sustainable byproducts, support sustainable infrastructure, and enhance rural prosperity.
- Diversity of plant and animal wildlife that draws visitors and residents to view scenery, fish, camp and hike, or engage in other forms of sustainable outdoor recreation.
- Increased resistance to current and future stressors and reduced risks to communities.

The Forest Service has been actively managing NFS lands for restoration for a considerable period of time and accelerating its efforts in recent years. These activities have been regularly accomplished, performed, and recorded in the Forest Service Performance Attainment System. The following table provides a brief summary of the recent levels of accomplishment related to restoration activities accomplished on NFS lands. Not all of the acreage identified in each of the categories provided below would have increased ecological integrity in those systems or would have been considered restoration activities. However, the trend in accomplishment of projects that increase or maintain ecological integrity is likely mirrored in the trend towards increased restoration activities (Table 2).

Table 2. Recent National Forest System Restoration Accomplishments

Restoration Accomplishment	2006	2007	2008	2009
Acres of forestland vegetation improved	62,185	60,658	240,058	264,500
Acres treated to restore fire-adapted ecosystems that are moved to desired condition	991,075	970,641	699,062	799,215
Percent of NFS land where fire risk is reduced by movement to a better condition class	1.1%	1.9%	2.1%	2.4%
Acres of noxious weeds and invasive plants treated	79,069	128,223	258,261	304,106
Acres of watershed improvement	16,934	27,297	105,288	203,508
Acres of terrestrial habitat enhanced	28,811	273,562	1,962,962	2,153,749
Acres of rangeland vegetation improved	1,755,824	2,021,505	867,748	1,892,194
Miles of stream habitat restored or enhanced	1,655	1,542	2,346	3,498

Source: FY2011 Forest Service Budget Justification (USDA Forest Service 2010h).

Increasingly, the Forest Service is emphasizing large-scale (tens of thousands of acres) restoration projects designed to maintain or improve ecological integrity across entire landscapes. Examples of large-scale restoration projects can be found along the Front Range of Colorado and in the national forests of northern Arizona. The general trends of increased emphasis on restoration and enhanced resilience are expected to continue to be part of the focus for projects in the future.

Evaluation of the Alternatives

Maintaining ecological sustainability through healthy, resilient terrestrial and aquatic ecosystems with greater ecological integrity is the primary indicator by which each of the alternatives being analyzed will be evaluated. The scientific information presented in the section of this chapter on Dynamic Nature of Ecosystems, especially the sections on Ecological Integrity and Resilience and Stressors and their Influence, along with background information presented in the Affected Environment provided above, will serve to inform the evaluation and analysis of an alternative's approach to this indicator.

Alternative A Effects

Effects on Plan Content and the Planning Process

A primary objective of the provisions required under Alternative A is to guide the collaborative and science-informed development, amendment, and revision of land management plans that promote the ecological integrity of terrestrial and aquatic ecosystems on national forests and grasslands so that they are ecologically sustainable and contribute to social and economic sustainability (§ 219.1). This alternative essentially adopts the definition of ecological integrity advanced by Parrish et al. (2003) as the quality or condition of an ecological system when its dominant ecological characteristics (e.g., elements of species composition and diversity, structure, function, and ecological processes) occur within the natural range of variation and can withstand and recover from most perturbations imposed by natural environmental dynamics or human disruptions.

This alternative clearly and explicitly focuses on maintaining desired ecological conditions where they currently exist and restoring ecological conditions that have been degraded, damaged, or destroyed. Under this alternative, restoration is defined as: "the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed" (Society for Ecological Restoration International Science and Policy Working Group 2004). Ecological restoration focuses on re-establishing the composition, structure, pattern, and ecological processes necessary to facilitate terrestrial and aquatic ecosystem sustainability, resilience, and health under current and future conditions (§ 219.19).

In terms of ecosystem restoration for long-term sustainability, this alternative requires:

- Best available scientific information will be taken into account regarding restoration activities relevant to individual plan areas (§ 219.3). In the preamble of the proposed rule, the Department's stated intent for this requirement was that the best available science would be used to inform decisions.
- An emphasis on collaboration and coordination with other landowners within the broader landscape (§ 219.4).
- The use of a planning framework of assessment, revision or amendment, and monitoring in a continuous learning cycle to facilitate adaptive management in a changing environment (§ 219.5).

- The responsible official to consider conditions, trends, and stressors with respect to the requirements for plan components of §§ 219.8 through 219.11 when developing or revising the plan (§ 219.7).
- The development of plan components to maintain or restore the structure, function, composition, and connectivity of healthy and resilient terrestrial and aquatic ecosystems and watersheds in the plan area, taking into account potential system drivers, stressors, and disturbance regimes, including climate change, and air quality (§ 219.8).
- The development of plan components designed to maintain, protect, or restore:; public water supplies, sole source aquifers, source water protection areas, groundwater, and other bodies of water; soils and soil productivity; riparian areas; and the diversity of ecosystems and habitat types throughout the plan area, including key terrestrial and aquatic ecosystem characteristics, rare aquatic and terrestrial plant and animal communities, and the diversity of native tree species (§§ 219.8 and 219.9).
- Monitoring the status of select watershed conditions, ecological conditions, and focal species, as well as monitoring measurable changes on the unit related to climate change and other stressors on the unit (§ 219.12).

Effects on Resources Expressed as General Outcomes Over Time

Based on the effects on plan content and the planning process provided above, the information and context specific to this issue provided in the Affected Environment for this section, and the scientific overview provided under the Dynamic Nature of Ecosystems section presented earlier in Chapter 3, the following statements can be made relevant to the effects that this alternative, if implemented, would have on restoring ecological conditions, improving ecological integrity, and maintaining sustainability on NFS lands.

The requirements in Alternative A directly and explicitly address ecological integrity and the enhancement of resistance, resilience, and adaptive capacity that are outcomes of improved ecological integrity. (See the previous section on Ecological Integrity and Resilience.)

The planning framework in Alternative A requires a collaborative and scientifically based process for establishing desired ecological conditions when identifying the need for restoration actions, while considering the inherent capability of the land, and the units' contribution to sustainable social, cultural, and economic systems. Its requirements for public engagement throughout the assessment, planning, and monitoring aspects of the land management planning process is intended to facilitate collaboration and coordination with other land management agencies, organizations, and entities within the broader landscape. This alternative's focus on assessing, restoring, and monitoring health and resilience would mesh closely with efforts currently underway on National Park System lands (Unnasch et al. 2009) and on lands managed by the Bureau of Land Management (Rapid Ecoregional Assessments). As a result of close coordination with neighboring land managers, the Agency's planning process could more fully address the ecological

integrity of ecosystems within the plan area and across the broader landscape, is intended to provide for more efficient and effective monitoring of ecological conditions needed to maintain or restore ecological integrity, and could more adequately address ecological connectivity and landscape permeability across the region than the planning process required under the 1982 planning rule.

Required plan assessments under this alternative would identify and evaluate ecosystem stressors and drivers and would assist in identifying potential plan components that would be appropriate to maintain or restore the composition, structure, function, and connectivity (ecological integrity) of terrestrial and aquatic ecosystems and watersheds. Plans would include components designed to maintain or restore the ecological conditions necessary to meet ecological integrity goals.

Monitoring at the unit and the broad scale is intended to: provide information on the implementation and effectiveness of restoration activities in improving ecological integrity and alleviating stressors; help to validate assumptions about the effects of changing conditions on resilience; and allow managers to assess the effects of management in the context or the larger landscape.

As an individual plan developed or revised under this alternative is implemented over time, restoration activities that alleviate ecosystem stressors by improving composition, structure, function, and connectivity would increase the ecological integrity of terrestrial and aquatic ecosystems within the plan area. Stressors (both those that management can control and those that management has little control over) would continue to affect terrestrial and aquatic ecosystems. However, ecosystems with higher ecological integrity are expected to be more resilient and resistant to these stressors, including climate change (see previous discussion on Ecological Integrity and Resilience). Examples of restoration activities that could improve or maintain ecological integrity are included under the Affected Environment portion of this section.

As forest and grassland plans revised or developed under this alternative are implemented over time, restoration activities that maintain or improve the ecological integrity of NFS ecosystems are intended to make them ecologically sustainable so that they continue to provide for species diversity, ecosystem services, and multiple uses into the future. Restoration activities may produce short term negative impacts in order to provide for long term benefits, but these impacts can only be assessed at the site specific level and will vary depending on type of restoration treatment, current condition of the resource and characteristics of the area being restored.

Modified Alternative A Effects

The effects of this alternative are the same as Alternative A. The terminology in § 219.8 and § 219.12 is changed from “health and resilience” to “ecological integrity” or “integrity of ecological conditions;” however, this wording reflects the intention of the preamble of the proposed rule (Alternative A) and does not result in a change in effects. For example, the preamble to the proposed rule (Alternative A) used ecological integrity as an indicator of ecosystem health, as it relates to an ecosystem’s composition, structure, function, and connectivity (76 FR 8492, February 14, 2011). The words “ecological

integrity" have been inserted into § 219.8 of Modified Alternative A to move the intent of the preamble of proposed rule into text of Modified A, while still focusing on structure, function, composition, and connectivity.

Alternative B Effects

Effects on Plan Content and the Planning Process

A primary objective of the provisions required under Alternative B is to provide for multiple use and sustained yield of goods and services in a manner that maximizes long-term net public benefits in an environmentally sound manner (§ 219.1). This alternative does not include a definition of ecological integrity or restoration. Provisions under this alternative related to vegetation management are largely provided within a context of providing goods and services (outputs) from NFS lands with consideration given to other ecosystem components and environmental factors.

In terms of ecosystem restoration for long-term sustainability, rule language in this alternative does not specifically require considerations for restoration during the planning process. Specific language that may relate to restoration includes:

- A review of other government agency(ies) planning and land use policies and consideration of objectives in those plans and policies.
- Provisions to manage habitat conditions that maintain the viability of all native and desired non-native vertebrate species (§§ 219.19 and 219.27).
- Identification of grazing lands in less than satisfactory condition and actions planned for their restoration (§ 219.20).
- Adoption of measures to restore floodplain values (§ 219.23).
- Specific requirement for management prescriptions to preserve and enhance the diversity of plant and animal communities based on the diversity of what would be expected in a natural forest or one similar to the existing diversity. This requirement allows for exceptions for species conversion based on a multiple-use justification and analysis (§ 219.27).

This alternative does not include monitoring requirements specific to maintaining or restoring ecological conditions.

Effects on Resources Expressed as General Outcomes Over Time

Based on the effects on plan content and the planning process provided above, the information and context specific to this issue provided in the Affected Environment for this section, and the scientific overview provided under the Dynamic Nature of Ecosystems section presented earlier in Chapter 3, the following statements can be made relevant to the effects that this alternative, if implemented, would have on restoring ecological conditions, improving ecological integrity, and maintaining sustainability on NFS lands.

Alternative B does not explicitly address ecological integrity and the enhancement of resistance, resilience, and adaptive capacity that are outcomes of improved ecological integrity. Its requirements for public engagement in the planning process could facilitate collaboration and coordination with other land management agencies, organizations, and entities within the broader landscape. However, because its focus on assessing, restoring, and monitoring ecological integrity is not explicit, the level to which plans will: fully address the ecological integrity of ecosystems within the plan area and across the broader landscape; provide for efficient and effective monitoring of ecological conditions needed to maintain or restore ecological integrity; and adequately address ecological connectivity and landscape permeability across the region would be expected to vary more widely between and among NFS units.

This alternative does not require an assessment of potential stressors to ecosystems within the plan area, including those related to climate change. Plans across the NFS will likely vary on whether or how they assess factors that detract from the ecological integrity of their relevant ecosystems, and on including plan components that are designed to maintain or restore the ecological conditions necessary to meet ecological integrity goals.

Since this alternative does not require monitoring of ecological conditions, plans developed under its requirements would continue to be variable in their approach to monitoring the implementation and effectiveness or restoration actions and their effects on ecological integrity.

Although restoration and resilience are not central objectives of land management planning under this alternative, plans recently revised under the 1982 provisions exceed current requirements and often include restoration of native ecosystems as a central objective. Plans would continue to include components to restore habitat conditions to support the viability requirements for vertebrate species. The trends of increased restoration at both the site and larger landscape scales would likely continue. However, there is greater uncertainty on what would be included in plans related to restoration, resilience, and connectivity and a greater range of potential outcomes under this alternative than under Alternatives A, Modified A, C, D, and E. Restoration would be driven by policy and direction other than the planning rule (e.g., Endangered Species Act, Clean Water Act, Agency policy, and social pressure). Degraded ecosystems on NFS lands would be expected to be restored; however, similar to Alternative C, the rate and extent of restoration is more uncertain under this alternative than under Alternatives A, Modified A, D, and E.

As forest and grassland plans that are revised or developed under this alternative are implemented over time, restoration activities that maintain or improve the ecological integrity of NFS ecosystems are more likely to vary widely in their approach to ecological sustainability as will their ability to continue to provide for species diversity, ecosystem services, and multiple uses into the future.

Alternative C Effects

Effects on Plan Content and the Planning Process

Alternative C retains a primary objective to guide the collaborative and participatory development, amendment, and revision of land management plans that promote the ecological integrity of terrestrial and aquatic ecosystems on national forests and grasslands so that they are ecologically sustainable and contribute to social and economic sustainability (§ 219.1). In terms of ecosystem restoration for long-term sustainability, rule language in this alternative specifically requires plan components designed to maintain or restore terrestrial and aquatic ecosystems and watersheds in the plan area (§ 219.8). It also places emphasis on collaboration and coordination with other government agencies and non-government entities during the land management planning process similar to that found in Alternative A and Modified Alternative A (§ 219.4).

It does not provide specific requirements to:

- Use the best available scientific information to inform planning decisions;
- Assess potential stressors, system drivers, and disturbance processes relevant to improving ecological integrity;
- Include plan components that maintain or restore the composition, structure, function, and connectivity of ecosystems within the plan area; or
- Monitor the implementation and effectiveness of management activities and their effects on desired ecological conditions.

Effects on Resources Expressed as General Outcomes Over Time

Based on the effects on plan content and the planning process provided above, the information and context specific to this issue provided in the Affected Environment for this section, and the scientific overview provided under the Dynamic Nature of Ecosystems section presented earlier in Chapter 3, the following statements can be made relevant to the effects that this alternative, if implemented, would have on restoring ecological conditions, improving ecological integrity, and maintaining sustainability on NFS lands.

The requirements in Alternative C do not directly address ecological integrity and the enhancement of resistance, resilience, and adaptive capacity—outcomes of improved ecological integrity (see previous section on Ecological Integrity and Resilience).

Similar to Alternative A and Modified Alternative A, land management planning in Alternative C requires a collaborative-based approach to the planning process. This is likely to facilitate collaboration and coordination with other land management agencies, organizations, and entities within the broader landscape. However, because its focus on assessing, restoring, and monitoring ecological integrity is not explicit, the level to which plans will: fully address the ecological integrity of ecosystems within the plan area and across the broader landscape; provide for efficient and effective monitoring of ecological conditions needed to maintain or restore ecological integrity; and adequately address

ecological connectivity and landscape permeability across the region would be expected to vary more widely between and among NFS units.

This alternative does not require an assessment of potential stressors to ecosystems within the plan area, including those related to climate change. Plans across the NFS will likely vary on whether or how they assess factors that detract from the ecological integrity of their relevant ecosystems, and on including plan components that are designed to maintain or restore the ecological conditions necessary to meet ecological integrity goals. While some form of assessment would likely continue under this alternative, there is more uncertainty as to what would be assessed and what information would be used. This could potentially allow for faster development of plans, plan amendments, and plan revisions and the flexibility allowed might provide opportunity for units to tailor assessments to address only the critical or unique needs of the unit.

Restoration of ecosystem composition, structure, and function is not explicitly required. Without some of the more detailed requirements found in the other alternatives, there would be greater flexibility for planning units to approach restoration and the improvement of ecological integrity in different ways. That flexibility leads to greater uncertainty as to whether restoration of key ecosystem components (e.g., riparian areas, source water protection areas, habitat of species at risk), not specifically required by the alternative, would be considered and included in plan revision or development. Management activities would be expected to continue the emphasis on restoration as described in the conditions and trends in the Affected Environment section.

There are no requirements to assure that scientific information would be appropriately interpreted and applied. Though based on recent plan revisions and Departmental and Agency policy, there is no reason to expect that scientific information would not be used to develop and monitor plans, but the degree and the documentation of how scientific information was used would vary.

The extent of monitoring and evaluation related to restoration of ecological conditions that maintain ecological integrity would be highly variable among NFS units.

Alternative C is intentionally designed to be non-prescriptive. The flexibility provided by this alternative could increase efficiency and allow opportunity for units to tailor assessment, revision or amendment, and monitoring to address only the critical or unique needs of the unit. Inherently, there would also be greater uncertainty as to whether restoration of ecosystem components not specifically required by the alternative would be considered and included in plan revision or amendment. Plans would include components that lead to restoration of terrestrial and aquatic systems, but there is a greater uncertainty as to what the outcomes, related to restoration, of these plans would be over time.

Alternative D Effects

Effects on Plan Content and the Planning Process

In terms of ecosystem restoration for long-term sustainability, the provisions required under Alternative A are common to Alternative D, with additional and more prescriptive requirements for coordination, watershed protection, and monitoring. The effects of this

alternative on plan content and the planning process relevant to ecosystem restoration would be similar to Alternative A, with the following additional requirements:

- An increased emphasis on coordination across multiple planning units for species viability, in plan development, assessment, and monitoring; and increased interagency coordination of the management of planning areas at the landscape level (§ 219.4).
- Watershed-scale assessments that include climate change vulnerability (§ 219.6).
- Additional emphasis on key watersheds within the plan area and spatial connectivity between watersheds (§ 219.8).
- Standards and guidelines for:
  - Protection, maintenance, and restoration of riparian conservation areas.
  - Connectivity of watersheds across the planning unit.
  - Protection, maintenance, and restoration of a natural range of variability in the sediment regime.
  - Road removal and remediation in key watersheds and riparian conservation areas as the top restoration priority (§ 219.8(a)(4)(vi)).
  - Further clarification and specificity for monitoring the effectiveness of desired ecological conditions, including the establishment of critical values to trigger reviews of planning and management decisions.

Effects on Resources Expressed as General Outcomes Over Time

Based on the effects on plan content and the planning process provided above, the information and context specific to this issue provided in the Affected Environment for this section, and the scientific overview provided under the Dynamic Nature of Ecosystems section presented earlier in Chapter 3, the following statements can be made relevant to the effects that this alternative, if implemented, would have on restoring ecological conditions, improving ecological integrity, and maintaining sustainability on NFS lands.

The effects on resources of this alternative are similar to those disclosed for Alternative A, with the following additions:

- The additional coordination requirements are likely to lead to more landscape-scale restoration approaches that use a single process coordinated among multiple partners to determine appropriate plan components and monitoring plans.
- Additional requirements to specifically conduct watershed-scale assessments that include an evaluation of climate change vulnerability would be part of the overall assessment for plan development or revision. These assessments would provide useful information for identifying characteristics of resilient watersheds and appropriate restoration actions to improve ecological integrity for vulnerable watersheds (see previous section on Ecological Integrity and Resilience). Watershed assessments may not answer all questions related to the restoration of

ecological integrity of terrestrial or aquatic ecosystems or restoration of landscape-scale habitats to support species viability, so assessments at multiple unit boundaries may be necessary.

- Plans would include plan components designed to restore riparian conservation areas, key watersheds, and sediment regimes. The consequences of these requirements are discussed in the section on Watershed Protection in this chapter. Restoration, specifically road removal, in riparian areas and key watersheds would be the highest priority. These restoration actions are likely to have positive effects on water quality, aquatic, riparian, and terrestrial habitat quality.
- Monitoring at the unit and the broad scale is expected to: provide information on the implementation and effectiveness of restoration activities in improving ecological integrity and alleviating stressors; help to validate assumptions about the effects changing conditions on resilience; and allow managers to assess the effects of management in the context or the larger landscape. Additionally, the requirement to establish critical values for review of decisions and activities may better facilitate adaptive management strategies.

Alternative D would generally be expected to maintain the focus and emphasis on ecological integrity similar to Alternative A. Additionally under this alternative, landscape-level restoration activities would be further informed by coordination with adjacent planning units, other landowners, and land managers engaged in species conservation. Three major differences between Alternative A and Alternative D are that, under Alternative D: (1) plan components for addressing species viability would generally be landscape-level strategies incorporated into the individual land management plans; (2) there would be a specified approach to aquatic restoration and resilience mandated for all plans; and (3) critical values for ecological conditions and focal species would be used to trigger reviews of planning and management decisions to achieve compliance with management direction (§ 219.12). Local approaches for addressing problems would have to fit within these frameworks.

As forest and grassland plans revised or developed under this alternative are implemented over time, restoration activities that maintain or improve the ecological integrity of NFS ecosystems are more likely to make them ecologically sustainable so that they continue to provide for species diversity, ecosystem services, and multiple uses into the future. Because of the additional specificity given to requirements for increased coordination across the landscape and greater emphasis on restoration activities in key watersheds and riparian areas, this alternative would be expected to decrease the variability among NFS units in maintaining or improving the ecological integrity of ecosystems across the NFS, particularly those elements related to watershed and riparian area conditions.

Alternative E Effects

Effects on Plan Content and the Planning Process

In terms of ecosystem restoration for long-term sustainability, the provisions required under Alternative A are common to Alternative E, with additional and more prescriptive requirements for assessments and monitoring under Alternative E. The effects of this

alternative on plan content and the planning process relevant to ecosystem restoration would be similar to Alternative A, with the following additional requirements:

- Increased emphasis on evaluation of ecological conditions, ecological integrity, and sustainability during assessment (§ 219.6).
- An expanded list of required monitoring questions and indicators beyond those required in Alternative A, and required signal points that alert the responsible official of the need to take action (§ 219.12).
- Required monitoring questions and indicators related to:
  - ✓ Key ecological conditions affecting species of conservation concern, with a focus on threats and stressors.
  - ✓ Status of key ecological variables for healthy and resilient aquatic and terrestrial systems.
  - ✓ Status and trends of vegetative diversity.
  - ✓ Status and trends of invasive species and effectiveness of management activities in controlling invasive species.
  - ✓ Status and trends of outbreaks of native insects and pathogens.
  - ✓ Risks and uncertainties associated with climate change.

Effects on Resources Expressed as General Outcomes Over Time

Based on the effects on plan content and the planning process provided above, the information and context specific to this issue provided in the Affected Environment for this section, and the scientific overview provided under the Dynamic Nature of Ecosystems section presented earlier in Chapter 3, the following statements can be made relevant to the effects that this alternative, if implemented, would have on restoring ecological conditions, improving ecological integrity, and maintaining sustainability on NFS lands.

The effects on resources of this alternative are similar to those disclosed for Alternative A, with the following additions:

- Nationally prescribed monitoring questions and required signal points could lead to the collection of more and more consistent information about restoration and ecological integrity. It is unclear whether all these questions and indicators would be important to inform restoration needs on each planning unit, or whether each unit can appropriately calibrate information to determine signal points, especially for questions where existing information is limited.
- Given limited budgets for monitoring, some important local needs for monitoring of restoration may not be monitored, because resources would go to meet the required questions. Standardized monitoring questions and methods could allow for data to be aggregated more efficiently to answer questions at higher ecological unit scales and may be more comparable between units.

- There would be more evaluation of ecological conditions and resilience during assessment for plan revisions and more monitoring of specific conditions and responses to restoration than under Alternative A.
- Signal points could potentially make management more aware and responsive when monitoring results are outside of expected levels.
- The difficulty of establishing statically and temporally significant signal points related to restoration, especially where there are insufficient data and where conditions are changing, would increase the complexity of planning.
- The prescriptive nature of the monitoring requirements might increase the ability to aggregate and compare data between units or at higher scales, but may also result in collection of data that are not necessarily relevant to the management of individual units or ecological conditions.

Diversity of Plant and Animal Communities

Affected Environment

Background and Context

This portion of the Affected Environment provides background information and context regarding the requirement in the National Forest Management Act (NFMA) to provide for diversity of plant and animal communities. It includes a brief overview of some of the biological resources involved with this issue. It discusses the role of the 1982 planning rule along with other applicable laws, Agency policy, and other considerations that currently influence Agency land management planning efforts. There is great public interest in how the Agency will maintain viable populations of species, manage habitats for fish and wildlife, and monitor the effectiveness of Agency actions in maintaining the biological diversity within plan areas. These three aspects of the Diversity of Plant and Animal Communities issue will be discussed and evaluated in this section. Much of the information presented in this section builds upon the concepts and principles presented earlier in this chapter under Dynamic Nature of Ecosystems.

The 193 million acres of national forests and grasslands support much of North America's wildlife heritage, including: habitat for 430 federally listed threatened and endangered species, with more than 12 million acres of terrestrial habitat and 22,000 miles of stream habitat on NFS lands designated as critical habitat for threatened and endangered species; 80 percent of the elk, mountain goat, and bighorn sheep habitat in the lower 48 States; 28 million acres of wild turkey habitat; a large majority of the Nation's remaining old-growth forests; 5.4 million acres of waterfowl habitat; habitat for more than 250 species of migratory birds; habitat for more than 3,500 rare and sensitive species; some of the best remaining habitat for grizzly bear, lynx, and many reptile, amphibian and rare plant species; more than 2 million acres of lake and reservoir habitat; and more than 200,000 miles of fish-bearing streams and rivers. A large percentage of the federally listed species known to occur on a national forest or grassland are highly dependent on habitats that occur on National Forest System (NFS) lands.

The Forest Service and NFS lands are major contributors to threatened and endangered (T&E, or federally listed) species recovery plans and actions. The Forest Service has long carried out actions to support the recovery of T & E species. Over the past 5 years, national forests and grasslands across the NFS implemented an average of approximately 800 projects per year that accomplished recovery activities on approximately150–205 threatened or endangered species per year (data taken from the USDA Forest Service Wildlife, Fish, and Rare Plant database). Examples of some of the types of recovery actions that have occurred on NFS lands and contribute to recovery of federally listed species include: maintaining habitat for red-cockaded woodpecker, Canada lynx, bull trout, and steelhead; supporting reintroduction activities for black-footed ferret, red-cockaded woodpecker, loach minnow, and spikedace; and contributing to T&E species monitoring programs.

Under the current Forest Service direction for management for threatened, endangered, and sensitive plants and animals, contained in FSM 2670, a biological evaluation (BE) is required by the Agency to analyze and document any potential effects of an action or proposed action on threatened, endangered, proposed, or Forest Service-listed sensitive (TES) species or critical habitats; and to determine the conservation significance of such effects. The Agency requires a BA for actions requiring an environmental impact statement which: may affect a threatened or endangered species or critical habitat; is likely to jeopardize the continued existence of a species that is proposed for federally listing; or may adversely modify designated or proposed critical habitat.

Over the past 10 years, the Forest Service has prepared nearly 62,000 BAs and BEs for Agency-proposed actions (plans, projects, programs, activities). Of those proposed actions, the Forest Service determined that approximately 80 percent would have “no effect” on T&E species or critical habitats. Consultation with the U.S. Fish and Wildlife Service (FWS) or the National Oceanic and Atmospheric Administration’s Fisheries Service (NOAA Fisheries) is not required for a “no effect” determination.

For each of the remaining 20 percent (13,000 proposed actions), the Forest Service determined that a proposed action may affect a federally listed species or modify designated critical habitat. As required by the ESA, the Forest Service consulted on those proposed actions with either the FWS or NOAA Fisheries. For approximately 80 percent (10,500) of those proposed actions, the Forest Service made a determination of may affect, but not likely to adversely affect T&E species or designated critical habitat, which means that the effects on T&E species or critical habitat were discountable, insignificant, or wholly beneficial. Many of these actions were beneficial to T&E species or designated habitats. Through informal consultation, the relevant reviewing agency concurred with the Forest Service determination on all of these actions.

For each of the approximately 2,500 remaining proposed actions, where the Forest Service determined the action was likely to adversely affect a T&E species or critical habitat, the Agency formally consulted with the relevant reviewing agency on whether the action was likely to jeopardize the continued existence of a T&E species or result in the destruction or adverse modification of critical habitat. Each of those formal consultations ended with the reviewing agency providing its Biological Opinion that the

proposed action was not likely to either jeopardize the continued existence of the species or result in the destruction or adverse modification of critical habitat.

Land management plans developed, revised, or amended under the provisions of the 1982 planning rule are the primary source of direction for maintaining species diversity, managing plant and animal habitats, and conducting monitoring on national forests and grasslands. Laws such as the Endangered Species Act (ESA), Migratory Bird Treaty Act, and the Bald Eagle Protection Act; specific Forest Service directives and policy; and advances in scientific understanding of how ecosystems function also have been very important in maintaining biological diversity. Laws, Forest Service directives and policy, and science all have greatly influenced forest and grassland plan components and the use of evolving approaches to achieve biological diversity conservation on NFS lands.

For land and resource management planning purposes, the 1982 planning rule relies primarily on selected management indicator species (MIS) to: establish fish and wildlife habitat management objectives, estimate the effects of plan alternatives on fish and wildlife populations, and monitor the effects of plan implementation on changes to fish and wildlife habitat conditions. The 1982 rule also recognizes the importance of providing for T&E species and the conservation of habitat conditions for such species. MIS can be chosen from five specified categories: (1) endangered and threatened plant and animal species identified on State and Federal lists for the planning area; (2) species with special habitat needs that might be influenced significantly by planned management programs; (3) species commonly hunted, fished, or trapped; (4) non-game species of special interest; and (5) additional plant or animal species selected because their population changes are believed to indicate the effects of management activities on other species of selected major biological communities or on water quality. The 1982 rule specifies that all five categories of MIS be considered, but also emphasizes that MIS "shall be selected because their population changes are believed to indicate the effects of management activities." The first three categories represent species whose inclusion is predicated first on a particular characteristic unrelated to whether the species is a good indicator of "the effects of management activities." The last two categories identify species that have the specific characteristics to be effective as indicators. The selection of MIS for the first generation of plans relied considerably on the first three categories, and especially on species that were commonly hunted, fished, or trapped. Some of the more recently revised plans selected MIS species that better represented environmental changes to habitat conditions and potential indirect effects to associated species than those selected in earlier plans.

Provisions under the 1982 planning rule have been used to develop, revise, and amend land management plans for 28 years. Strategies for maintaining and monitoring biological diversity have evolved over that time period, and many recent plan revisions have incorporated these contemporary approaches to varying degrees.

A review of eight recently revised plans from across the country provides the following findings:

- Approximately two-thirds of the MIS selected were in the first three categories, with nearly 25 percent of all selected MIS being species that are commonly

hunted fished or trapped. One-third of the MIS selected were plant or animal species selected because their population changes are believed to indicate the effects of management activities on other species.

- Fifty percent of these plans include requiring a combination of MIS population monitoring and habitat monitoring. One plan relies primarily on population monitoring, and three plans rely primarily on habitat monitoring. Most of these plans require monitoring general ecological conditions, although only a small minority refers specifically to monitoring key characteristics representative of compositional, structural, or functional components on the landscape.

Assumptions and Uncertainties

This portion of the Affected Environment discloses some of the assumptions and uncertainties that are largely unrelated to the planning rule, and might influence plans and plan outcomes in the future. A variety of extrinsic factors, influences, and conditions that affect threatened, endangered, proposed, and candidate species and critical habitat, as well as other plant and animal communities, on the NFS are expected to continue, independent of any planning rule. Climate change, changing land use patterns, and other environmental stressors are expected to influence ecological conditions on NFS lands to some degree. Currently, there is insufficient understanding of the nature or magnitude of impacts on species from these factors. However, the extent to which a planning rule would ameliorate some of the potential impacts of these changes varies by alternative.

The effects of climate change on the current and desired ecological conditions within plan areas across the NFS are difficult to predict and will vary from unit to unit. Consequently, the Agency's ability to maintain or restore the necessary ecological conditions within a plan area needed to maintain the existing diversity and persistence of all species native to those areas or contribute to the viability of species whose populations extend beyond the plan area is uncertain. While the particular effects of climate change are uncertain, empirical evidence demonstrates that species' geographic distributions are shifting. This will result in the loss of species from some areas and the movement of other species into areas they did not previously occupy. These shifts in distribution will result from a combination of a change in the climate experienced directly by species; and from the resulting changes in habitat, predator prey relationships, competitive interactions, and other ecological interactions. Consequently, the inherent capability of the land to support particular elements of biodiversity will change regardless of land management practices, and in some cases despite efforts to resist those changes. Expected changes in climate over the next several decades will influence existing or expected habitat conditions, species distribution, and landscape connectivity. Also see previous section in this chapter discussing Stressors and Their Influence.

Large, high-intensity wildfires, insect and disease epidemics, changing atmospheric conditions, and the spread of invasive species are examples of other types of environmental stressors that can be highly unpredictable and difficult for the Agency to manage or control. These, too, will influence ecological conditions and species diversity on national forest and grassland units in ways that are difficult to predict. Changing land use patterns and other activities on lands adjacent to national forests and grasslands can

affect species distribution and persistence within plan areas. Additionally, changes occurring at a distance from NFS lands, such as on migration routes or wintering grounds, will also affect species diversity on a national forest or grassland in unpredictable ways.

The shifting nature of the Agency's budgets, staffing, and program emphases along with legal requirements that both directly and indirectly influence land management will continue to occur beyond the scope of a planning rule. Those shifts also create some level of uncertainty as to how plans and projects will be developed and implemented.

Forest Service policy direction relevant to the diversity of plant and animal communities can be found in the Forest Service Directives System. These and other Forest Service policies will continue to provide additional specific direction for land management planning and project-level activities. These directives can be periodically revised to reflect changes in planning rule requirements, Agency policies, and new scientific information.

The Interim Update of the 2000 Renewable Resources Planning Act Assessment (USDA Forest Service 2007c) makes the following summary statements and assumptions relevant to plant and animal diversity and to T&E conservation on NFS lands:

- The largest reserves of intact forest are concentrated on public lands and the largest share of intact forest is contained in the NFS. For some types of ecosystems, only NFS lands contain significant amounts of intact forest.
- The status of adjacent private lands can determine the degree of intactness that can be achieved on public lands. For example, urbanization of private land next to public land increases the likelihood of invasive species on the public land. Even if public lands can be kept intact, changes in biological diversity will occur as forests and habitats evolve and as natural disturbances/succession lead to change such as the decline in aspen in parts of the West and North.
- Those species that have been able to adapt to human activities did well in the 20th century, as have species such as elk that are highly valued and managed by humans. Species that need large undeveloped landscapes or specialized habitats vulnerable to development pressures did not do as well. Many species that are formally listed as threatened or endangered share some of these characteristics.
- The rate of species listed as threatened or endangered has declined five-fold since the 2000 RPA Assessment (USDA Forest Service 2001b). This decline may not reflect so much on the condition of threatened and endangered species as on funding and other factors. Conservation efforts should continue to focus on those areas supporting higher numbers of species thought to be at risk of extinction. Most future forest loss will be to development/urbanization. We can expect more widespread occurrences of invasive species as development progresses.
- The area of private lands protected by conservation easements is growing. These easements offer various levels of protection, but most minimize the possibility for urbanization.

- A development of the past 15 years has been forest industry's sale of large parcels of timber land, primarily to timber investment management organizations and real estate investment trusts. The objective of industry ownership was generally to protect a source of timber supply and reduce the risks of timber price volatility. Because the industry managed its lands for timber production, this ownership generally assured maintenance of large landscapes. The sale of forest industry lands creates uncertainty about the long-term nature of these lands and the implications for associated biodiversity.
- Stability in the area of forest land does not mean that no changes have occurred in forest area. Between 1982 and 1997, 23 million acres went out of forest land and 26.6 million acres went into forest land. Areas converted from forests went mainly to developed uses. Areas going into forest came primarily from pasture land.
- Forests in the United States are getting older. This aging will lead to increased diversity of forest structure, but to a decreased diversity of forest types because later successional stages will continue to increase at the expense of earlier successional stages. Although forests are getting older, duplication of pre-European conditions is not possible.
- Expected increases in plantation areas in the South will be the source of much of the United States' increase in softwood timber supply. This increase will tend to decrease prices and reduce pressure for harvest on some private timber lands. Reduced harvest will change the dynamics of temporal changes in habitat and biodiversity.
- The changing U.S. population is expected to demand increased ecosystem services coming from forest land and rangeland resources, including fresh water, protection from drought and floods, carbon storage, recreation, and other cultural benefits.
- Total forest land in the United States has remained relatively stable at about 750 million acres since 1900, but this stable trend masks dynamic shifts among forest types, forest age classes, and how forest cover is arranged on the landscape due to land use intensification. As an example of the regional shifts, forest cover is declining in all six New England states for the first time in 150 years (Foster et al. 2010). Keeton (2007) further states: "In the 1990's more than 80% of housing development was in rural areas (Heimlich and Anderson 2001); each year the U.S. loses almost 500,000 ha of forestland to the 'direct footprint' of development and other land conversions, and there is a much larger 'indirect footprint' that includes fragmentation effects (USDA Forest Service 2004)."
- The area of rangeland in the United States has slowly declined from about 800 million acres in 1900 to approximately 580 million acres today. Rangeland area is projected to decline slowly over the next 50 years
- Concurrent with climate change could be land cover and land use changes, increases in atmospheric pollutants such as ozone and nitrous oxides, and

potential expansion of exotic plants and animals, some of which might be considered invasive.

- The largest reserves of intact forest in the United States are concentrated on public lands, with the largest share of public intact forest contained in the National Forest System (NFS). Since private lands can limit the degree of intactness on adjacent public lands, joint management might be needed to achieve a specified level of forest intactness.
- Geographic areas within the United States that have high levels of threatened and endangered species continue to be concentrated in the southern Appalachians, coastal areas, and the arid Southwest.

Should these statements and assumptions continue to remain valid, they, too, could have a bearing on plan development, revision, or amendment.

Circumstances Beyond the Authority of the Agency or Not Consistent with the Inherent Capability of the Land

There will be situations where the Agency may be unable to maintain ecological conditions for viable populations of a species within a plan area because it is outside the Agency's authority or beyond the inherent ecological capability of the land to produce adequate ecological conditions to do so. These circumstances reflect limitations to the Agency's ability to control or influence a species' viability within a particular plan area.

A few species-specific examples of circumstances that are not within the authority of the Agency and may affect a national forest or grassland's ability to maintain ecological conditions for a viable population of a particular plant or animal species within a plan area include:

- Forest clearing in South America – These forests provide important wintering areas for many neotropical birds that nest in North America. The clearing of these forests for agricultural purposes poses a serious threat to the long-term viability of the cerulean warbler and the ability of national forests in the southern Appalachian Mountains to maintain populations of this species.
- Hydropower facilities in the Pacific Northwest and off-shore fishing harvest practices – These facilities and practices are primary downstream threats to chinook salmon populations whose spawning beds may occur on stream reaches within national forests in the Intermountain West, thus affecting the ability of national forests within this salmon's range to maintain viable populations of this species on their respective units.
- Land use patterns on private lands within and adjacent to NFS units, such as the continuing agricultural uses and urbanization that is occurring east of the Rocky Mountains – Habitat fragmentation as a result of these changes reduces available habitat and further isolates existing swift fox populations, thereby affecting the ability of national grasslands in eastern Colorado to maintain viable populations of this species.

- Domestic sheep grazing on private lands within or adjacent to national forests – Domestic sheep can transmit diseases to bighorn sheep that can cause die-offs affecting herds on national forests in the West and the ability of those NFS units to maintain viable bighorn populations.

The inherent capability of the land represents the ecological capacity or ecological potential of an area characterized by the inter-relationship of its physical elements, its climatic regime, and natural disturbances. It represents the ecological capacity of an area to express a defined range of biophysical conditions (ecosystems).

Examples of circumstances that are not consistent with the inherent capability of the plan area to maintain or restore ecological conditions to maintain a viable population of a species within the plan area include:

- Species that are inherently rare because they occur at low numbers and are wide-ranging individuals, such as the wolverine. This species occurs at relatively low densities in the northern Rocky Mountains, where the number of breeding individuals that may occur on an individual national forest are presumably too small to be considered a viable population.
- Plan areas that lack sufficient land area with the ecological capacity to produce enough habitat to maintain a viable population within the plan area. An example is the Kisatchie National Forest's inability to maintain a viable population of swallow-tailed kite on the forest because of very limited amounts of land area ecologically capable of producing broad bottomland hardwood and cypress swamp habitats.
- Current and projected changes in climate may also affect a national forest or grassland's ability to maintain or even contribute to viable populations of some species. An example is the warming trends of temperatures at higher elevations in the West, which are altering the capability of national forests, such as the Shoshone National Forest in western Wyoming and the Sierra National Forest in California, to maintain whitebark pine on the landscape and viable populations of species that are highly associated with these forests, such as grizzly bear.
- Water quality conditions in Appalachian Mountain streams that provide habitat for eastern brook trout have been altered through acid deposition due to past and current acid rain, rendering many of them unsuitable for brook trout and compromising the ability of some Appalachian national forests to maintain viable populations of this species.

Current Science

Maintaining conditions for species diversity and population viability at various scales, managing for ecological conditions, and monitoring strategies for effectively assessing ecosystem integrity are important aspects to the conservation of native species across broad landscapes. The past three decades have seen considerable advancement in the scientific understanding of biological diversity, as well as in conservation design and practice. This portion of the Affected Environment section provides a brief background

of the current science related to the ecological maintenance of biological diversity and conservation design and practice.

Maintaining Species Diversity and Population Viability

Long-term security of species improves as their distribution increases and the required habitat conditions improve. Maintaining populations of a species widely distributed across the landscape and throughout their geographic range has a positive relationship on its local abundance (Brown 1984, Gaston 1996), and increases the likelihood of its persistence (Lande 1993). This effectively decouples the temporal dynamics among local populations of a species and thereby decreases the probability that all local populations will decline simultaneously.

The conservation of biological diversity is one of the fundamental principles for ecologically sustainable land management. By maintaining functionally viable populations of all species and the essential ecosystem processes that they provide, the long-term productivity of ecosystems and their ability to produce goods and services for human use will be sustained (Lindenmayer and Franklin 2002). Current conservation biology literature discusses a variety of approaches to conserving biological diversity across broad landscapes. It is important to recognize that many of these approaches are conceptual and have not been fully tested at a landscape scale over a long period of time. Thus, there is uncertainty as to the efficacy of these approaches to maintaining all species on those landscapes in the future. These approaches include bioreserve, matrix-based, emphasis-area, coarse-filter, and fine-filter strategies and various combinations of these (Baydack et al. 1999, Noon et al. 2009, Lindenmayer and Franklin 2002). Lindenmayer and Franklin (2002) go on to recommend a multifaceted approach that incorporates multiple approaches at multiple scales. They term this "risk-spreading," as it reduces over-reliance on a single approach that may not fully meet land management conservation goals.

The evaluation and analysis of the approaches proposed within the alternatives being analyzed in this final programmatic environmental impact statement focus on the coarse-filter (ecosystem) and fine-filter (species) strategies. A coarse-filter strategy has the ability of incorporating multiple approaches needed to address habitat conditions at various geographic scales, from the landscape-scale down to the stand- or site-scale.

Because all species are fundamentally distinct from one another, designing a management approach that conserves all native plant and animal species within an area is difficult to achieve. The essential habitat elements for many species are either unknown or, if known, will have habitat requirements that will conflict. Thus some species populations may increase while others will decline in response to management actions or disturbances. This constantly shifting of habitat mosaic of existing habitat conditions highlights the need to consider habitat requirements over broad geographic areas and over extended time periods to accommodate the diverse needs of species occupying a particular landscape. Designing a comprehensive multi-species conservation planning approach usually involves some form of a coarse-filter and/or fine-filter approach (Cushman et al. 2008; Haufler 1999b; Hunter et al. 1988; Hunter 1990, 1991; Noss 1996; Noss and Cooperrider 1994).

Coarse-filter strategies are based on providing a mix of ecological communities across a planning landscape rather than focusing on the needs of specific individual species, with the goal of providing for ecological integrity or biological diversity at an appropriate landscape scale (Kaufmann et al. 1994). The premise behind a coarse-filter approach is that native species evolved and adapted within the limits established by natural disturbance patterns, prior to extensive human alteration, and that a patch-work of variable habitat conditions ranging from optimum to poor existed and shifted across the landscape. In order to reflect underlying ecological processes, these conditions are considered to function at large spatial (hundreds of square miles) and temporal scales (generations to centuries). Also see previous section on Dynamic Nature of Ecosystems.

A coarse-filter approach generally does not rely on direct measurement of wildlife species (Noon et al. 2009). However, initially at least, some amount of direct species measurement may be needed to assess the effectiveness of the ecological conditions provided under the coarse-filter approach in achieving the goal of conserving the biological diversity of the area. Providing or emulating a range of ecological conditions similar to those that sustained native species in the past offers the best assurance against losses of biological diversity and maintains habitats for the vast majority of species in an area. The underlying assumption is that the ecological conditions provided by an effective coarse-filter approach contribute to the overall biological diversity across the entire plan area. With a biologically effective coarse-filter approach in place, the more costly and information-intensive fine-filter strategies can be focused on the few species of special concern whose habitat requirements are not fully captured by coarse-filter attributes (Seymour and Hunter 1999). Critical to the understanding of an effective coarse-filter approach is the classification of a planning area into areas with similar ecological capabilities. The ability of land management agencies to properly partition the landscape in an ecologically appropriate manner, given the dynamic nature of ecosystems and an accurate understanding of the historical range of variability, can be difficult, and injects a level of uncertainty into the overall effectiveness of the design (Haufler et al.1999). Also see the previous section on Historical Range of Variability as a Way of Understanding the Historical Nature of Ecosystems and Their Variation. Noon et al. (2009) caution that if coarse-filter conditions are defined only as characteristics of vegetative patches in terms of their dominant vegetation (cover-type) and successional stages, their ability to provide for native species will be limited and insufficient for many species. Cover-type models have been shown to be inaccurate more than 20 percent of the time in predicting the presence and/or absence of animals, even at a regional scale (Schlossberg and King 2009).

Fine-filter approaches for maintaining biological diversity are based on providing the specific habitat elements needed by individual species, guilds of species, or other groupings of species. Assumptions underlying this approach are that biodiversity can best be maintained by managing habitat for the needs of all species by either considering species individually or by aggregating species into groupings, and that coarse-filter approaches might not adequately provide the ecological conditions necessary to support every species (Baydack et al. 1999). Fine-filter strategies rely on an understanding of individual species' life requirements and demographic information, and on direct measurements of critical habitat elements needed for their survival, distribution, and

Example of an all-lands, watershed partnership restoration project on the Umatilla National Forest:

Restoration projects in the Asotin Creek Watershed, conducted between 1999 and 2003, emphasized improvement of riparian/ floodplain vegetation conditions and the recovery of stream channel stability. In addition, there were a number of projects on private land, addressing the agricultural and livestock uses in the watershed, including the development of alternative watering sites and planting of pastureland.

Restoration accomplishments include: 72.5 miles of road decommissioning and recontouring; 85,191 trees planted in riparian areas; 15,100 linear feet of livestock fencing installed; 15 troughs and off-water sites created for livestock; 8.3 miles (151 acres) of stream buffer protected and enhanced; wood and boulders added to stream channels; 122 pools constructed, adding to stream habitat complexity; 1,330 feet of stream channel reconstructed with meanders; 14 sediment ponds completed; and 4,000 acres of grass pasture plantings.

Monitoring of in-channel stream conditions, fish populations, and riparian vegetation is a cooperative effort between the Forest Service, the State, and Asotin County Conservation District.

- Instream projects have increased the number and quality of pools while reducing the width of the stream channel.
- Surveys show that the number of pools has increased by more than 1/3 since treatment.
- Summer stream temperature monitoring shows temperatures have been reduced sufficiently to increase habitat for ESA-listed trout and salmon by approximately 5 miles.
- Monitoring indicates a substantial reduction of sediment in the stream bed, enhancing water quality and fish habitat.
- 72.5 miles of roads have been decommissioned and re-contoured since 2000.

abundance. Some advantages to a fine-filter approach are that it can better address the needs of federally listed species and other rare or vulnerable species that might not be adequately considered through the use of a well-designed coarse-filter approach. Fine-filter approaches can also be designed in such a way as to balance the needs of a species with other resource objectives. However, there is insufficient knowledge to adequately describe the habitat requirements of all species within an area, which makes it extremely difficult to relate the status and trends of one species, or a group of species, to all other species associated with its habitat. Fine-filter approaches generally do not take into account ecosystem functions and disturbance regimes, which could be critical to maintaining the overall biological diversity in an area (Haufler 1999a). The uncertainty involved with relying solely on a fine-filter approach for maintaining the viability of all native species over a broad landscape is high, and would be highly reliant on a clear understanding of the ecosystems and ecological processes within the plan area and the number of species being directly evaluated.

Modern designs for conservation of biological diversity combine the characteristics of managing broad ecosystem characteristics (coarse-filter approach) with species-specific (fine-filter approach) management to form a coordinated fabric of conservation.

Managing Ecological (Habitat) Conditions

Any comprehensive strategy for conserving biological diversity requires maintaining habitat across a variety of spatial scales and includes maintenance of connectivity, landscape heterogeneity, structural complexity, and integrity of aquatic systems (Lindenmayer and Franklin 2002). Habitat is a specific combination of interdependent biotic and abiotic components and processes that occur at multiple scales, and provides the necessary resources for individuals to survive and reproduce, local populations to persist, and the species to remain viable within its range. Habitat varies both in space and time. (See discussions on this in the Dynamic Nature of Ecosystems section presented earlier in this chapter.) For any individual species, habitat use and selection are complex processes influenced by the physiological and

morphological adaptations of a species and its innate and learned behavioral responses to its environment (Block and Brennan 1993).

The best opportunity for maintaining species and ecological integrity is to maintain or restore the composition, structure, ecological functions, and habitat connectivity characteristics of the ecosystem. These ecosystem components, in essence, define the coarse-filter approach to conserving biological diversity. This approach provides for a range of species habitat conditions at a variety of spatial scales over the long term and offers the best possibility of maintaining biological diversity for the vast majority of species (Hunter 1990, Committee of Scientists 1999). An understanding of past, current, and projected future disturbance regimes and their influence on the composition, structure, and spatial arrangement of vegetation is critical to conserving biological diversity at broad spatial scales (Haufler 1999b). Examples of *compositional characteristics* of ecosystem diversity include: individual species and populations of species, plant and animal communities, distribution and extent of major vegetation types; presence and distribution of invasive species; and types of wetlands, lakes, streams, and ponds. Examples of *structural characteristics* include: vertical and horizontal distribution of vegetation and its pattern; size and density of trees and understory vegetation; seral stage; size, amount, and distribution of dead wood; landscape patch characteristics and connectivity among habitats; stream habitat complexity; and riparian habitat structure. Examples of *ecological functions* include: soil formation and movement, decomposition and mineralization, nutrient and water cycling, species interactions, and ecological processes; types, frequencies, severities, and spatial patterns of disturbances such as fires, landslides, and floods; successional pathways and habitat turnover rates; stream and lake temperature and nutrient regimes; riverine flow dynamics and associated geomorphic changes; aquatic nutrient cycling; and soil productivity. The integration and interaction of these characteristics of ecosystem diversity provide the array of habitat conditions and characteristics inherent in an area from snags and down logs, to patches of old-growth forest or stretches of pools and riffles in a stream, to broad landscapes of intermingled vegetation types with varying physical, biological, and climatic features. Also see previous section in this chapter on Dynamic Nature of Ecosystems. A brief discussion of functional habitat connectivity can be found under Stressors that Alter Landscape Patterns and Habitat Connectivity in the Ecosystem Restoration section of this chapter.

Monitoring to Assess Effectiveness

Resources and current knowledge are inadequate for directly assessing the viability of all plant and animal species on a national forest or grassland. Nonetheless, land managers must assess the management effects on ecosystems and potential changes to species diversity. The assessment of any complex system, such as an ecosystem, has required some type of surrogate-based approach. Surrogate species have been used to assess, solve, and monitor a wide variety of conservation issues (Caro and O'Doherty 1999). A variety of species categories have been advanced to assess broad-scale effects, believing they provide information about the welfare or condition of other species. The scientific literature discusses the use of species or groups of species as indicators for assessing ecological sustainability, habitat conditions, or populations of other associated species (Committee of Scientists 1999, Cushman et al. 2010, Halme et al. 2009, Hunter 1999,

Lambeck 1997, Landres et al. 1988, Lawler et al. 2003, Lindenmayer et al. 2000, Noon et al. 2009, Patton 1987, Wiens et al. 2008). Use of invertebrates as indicators of the integrity of aquatic systems has a strong foundation in the peer-reviewed literature (Karr 1981). However, the use of a wildlife species or group of species to assess the populations of other species in terrestrial ecosystems has been criticized extensively (Landres 1988, Verner 1984). Some of the major criticisms of their use include: species occupy different niches, so changes in the population of one species might not directly indicate changes to other "associated" species; population regulatory mechanisms vary among species; and presence in a particular habitat type might not indicate optimal conditions (Thompson and Angelstam 1999).

Evaluation and analysis of monitoring approaches analyzed in this final programmatic environmental impact statement focus on the use of ecosystem characteristics, management indicator species (MIS), and focal species. The primary purposes for monitoring are to evaluate the effectiveness of management approaches, ensure the reliability of implementation, and validate the assumptions used in predicting the consequences of the management approaches. Effective monitoring plans should contain monitoring measurements and methods at multiple spatial and temporal scales. Protocols for monitoring ecological conditions should address what characteristics of ecological systems to measure, how to link changes in these characteristics to ecological integrity, and how to use the information to improve or change future management actions. Critical to this process will be selecting appropriate biotic and/or abiotic indicator variables, including plant or animal species (focal species), whose values are indicative of the integrity of the larger ecosystem (Committee of Scientists 1999). Selection of appropriate indicators will be based upon geographic variation in patterns of habitat and resource use. Given the uncertainty related to assessing the effectiveness of ecological conditions in achieving biological diversity goals, monitoring aimed at evaluating the effectiveness of management approaches may be more effective in an adaptive management context.

Monitoring Ecosystem Characteristics

Ecological conditions can be monitored and assessed by measuring various characteristics related to ecosystem composition, structure, and function. Characteristics of ecosystem diversity that are function-based indicators include direct measures of processes and their rates, such as primary productivity, rates of nutrient cycling, and water flows. Structure-based indicators include the structural complexity of vegetation, among-patch heterogeneity, landscape connectivity, and landscape pattern. These could be measured at multiple spatial scales from local to regional. Composition-based indicators include presence of individual species, species composition within communities, representation and distribution of community types, and species populations. Some composition-based indicators require measurements at the species level including species distribution, life history, demography, and behavior. Composition-based indicators at the species level are analogous to the fine-filter (Noon et al. 2009).

Monitoring Management Indicator Species

The selection of management indicator species (MIS), as described earlier in the Background and Context part of this section, is required under the 1982 planning rule and serves a wide range of purposes. For example, some were selected because they represented species that were commonly hunted, fished, or trapped on the forest or grassland and were of high public interest. Federally listed threatened and endangered species were often selected to focus management strategies on contributing to their recovery or maintaining critical habitat within the plan area. When used in these ways, the MIS concept has been effectively used to assess plan implementation related to these categories of species. However, another major use of the MIS concept has been to use a selected MIS as a surrogate to indicate plan implementation effects on other species with similar habitat requirements. Using MIS in this way has achieved mixed success and drawn heavy criticism. An assumption is that some MIS can be used to describe effects on a broader group of species. Scientific criticisms of this assumption include the following arguments:

- Members of the same guild are not alike in the ways they use habitat for various purposes. The presence of one species might in fact exclude another that is very similar in resource exploitation (Root 1967, Schoener 1983).
- Although members of a guild might exploit the same environmental resources, each species, by definition, has unique characteristics and behaviors. This makes extrapolation from one species to another difficult or impossible. For example, in an analysis of 19 bird species, population responses of component species in four of five guilds did not exhibit parallel trends, and even the direction of change was inconsistent (Mannan et al. 1984).
- Animals might change their behavior and use habitats differently between seasons or in different parts of the species' range. This complicates the building of guilds and makes identification of a representative species uncertain in the absence of local studies (Verner 1984).
- Population density of a particular species might be limited by habitat, predation, disease, weather, and/or other factors. Thus, habitat trend might not accurately predict population trend. Interactions among multiple management activities might make the response of a species difficult to interpret (Landres et al. 1988, Patton 1987, Van Horne 1983).

The response of animals to their environment is not a simple relationship. One species cannot be expected to very precisely reflect the response of another species or group of species (Morrison et al. 1992). However, it can be argued that well-chosen MIS can in fact provide valuable information on ecological/habitat conditions or on effects on some other species. For example, acreage of occupied prairie dog habitat and its inferences for the occurrence, distribution, and persistence of burrowing owls, black-footed ferrets, and mountain plovers; or the presence of beaver and their influence on sediment capture, water storage, riparian habitat development, or aquatic habitats. Nonetheless, there is also evidence that some selected MIS have not provided the ecological information needed to

assess the effects to habitat conditions or populations of associated species (Hayward et al. 2004).

Monitoring Focal Species

The Committee of Scientists (1999) advanced the term "focal species" to allow for a variety of approaches to selecting species whose status and trends provide insights to the integrity of the larger ecological system to which it belongs. Their use of the term focal includes several existing categories of species used to assess ecological integrity, such as indicator species, keystone species, ecological engineers, umbrella species, link species, strong interactors, and species of concern. Focal species would commonly be selected on the basis of their functional role in ecosystems, for example: species that act as ecosystem engineers by modulating the availability of resources to other species through changes in biotic or abiotic materials, thus creating or maintaining habitats (Jones et al. 1994); ecological indicators that indicate the action or consequences of key environmental stressors; or strongly interactive species that are disproportionately significant to the survival of other native species and ecosystems, such as plants that provide critical resources, insect pollinators, and carnivores (Soulé et al. 2005). Noon et al. (2009) recently reviewed categories of focal species, methods to identify them, and how they may be used to monitor the effectiveness of ecological conditions in meeting biological diversity goals on Federal public lands.

There are a wide variety of monitoring methods that can be used to monitor focal species for the purposes of assessing ecological conditions. An example includes recent advancements in wildlife monitoring based on the use of presence-absence data to determine the area occupied by a species, a measure of a species' spatial distribution (Manley et al. 2005, Vojta 2005). Area occupied serves as an index of species abundance in the survey area. Area occupied is a tenable index of abundance based on the well-established positive relationship between a species' abundance and its geographic distribution (e.g., Brown 1984, Gaston 1996, He and Gaston, 2003). This type of data collection is relatively inexpensive, allows an exploitation of historical survey data, and can make use of recent advancements in genetic evaluation (MacKenzie et al. 2005). If genetic markers are available, it is relatively straightforward to identify the sample by species on the basis of its DNA signature, and often to the individual level (Schwartz et al. 2006). The ability to use indirect measures of presence for some species greatly increases monitoring efficiency and reduces survey costs. Temporal and spatial patterns in presence-absence monitoring data also allows inference to changes in animal abundance (MacKenzie and Nichols 2004), the single most important parameter that provides insights into likelihood of species persistence (Lande 1993).

Evaluation of the Alternatives

Maintaining species diversity and population viability, managing ecological (habitat) conditions, and monitoring strategies for effectively assessing ecosystem integrity will serve as indicators of the Diversity of Plant and Animal Communities issue. The Current Science discussion in the Affected Environment provided here and the scientific overview provided earlier in this chapter under the Dynamic Nature of Ecosystems section of this chapter will serve to inform the evaluation and analysis of each

alternative's approach to each of these indicators, and analyze each alternative's effects by means of these indicators.

Alternative A Effects

Maintaining Species Diversity and Population Viability

Effects on Plan Content and the Planning Process

Sections 219.8 Sustainability and 219.9 Diversity of Plant and Animal Communities of Alternative A set forth requirements relevant to maintaining species diversity and managing ecological (habitat) conditions on national forests and grasslands. A primary goal of the provisions of these sections is to provide ecological conditions to maintain the diversity of plant and animal communities and support the persistence of native species in the plan area. The provisions of § 219.9 in this alternative explicitly require a complementary ecosystem and species-specific approach to achieving this goal across the NFS. This approach represents a combination of the coarse-filter and fine-filter approaches for maintaining biological diversity and is intended to provide the range and mix of ecological conditions, both spatially and temporally, which supported and sustained native species in these areas in the past. The combined approach required by this alternative is based in the principle that retaining or restoring native ecosystems and maintaining the persistence of native species cannot be separated.

In terms of maintaining species diversity, rule language in this alternative specifically requires:

- The best available scientific information will be taken into account to inform the assessment, plan development, and monitoring (§ 219.3).
- An emphasis on collaboration and coordination with other landowners within the broader landscape (§ 219.4).
- The use of a planning framework of assessment, planning, and monitoring in a continuous learning cycle to facilitate adaptive management in a changing environment (§ 219.5).
- The identification and evaluation of information needed to understand and assess the existing and potential future conditions and stressors to inform the development of plan components designed to meet the provisions in the sustainability (§ 219.8) and diversity of plant and animal communities (§ 219.9) sections.
- The development of plan components designed to maintain or restore the health and resilience of terrestrial and aquatic ecosystems and watersheds, with additional emphasis specifically given to maintaining or restoring aquatic elements, terrestrial elements, rare plant and animal communities, and riparian areas (§ 219.8).
- The development of plan components designed to maintain or restore the structure, function, composition, and connectivity of terrestrial and aquatic ecosystems to maintain the diversity of native species; the ecological conditions

that contribute to recovery of federally listed threatened and endangered species, conserve candidate species, and maintain viable populations of species of conservation concern within the plan area; and the diversity of native tree species (§ 219.9).

- Monitoring the status of select watershed conditions, select ecological conditions, and focal species and monitoring measurable changes related to climate change and other stressors on the unit (§ 219.12).

Effects on Resources Expressed as General Outcomes Over Time

Based on the effects on plan content and the planning process provided above, the information and context specific to this issue provided in the Affected Environment for this section, and the scientific overview provided under the Dynamic Nature of Ecosystems section presented earlier in this chapter, the following statements can be made relevant to the effects that this alternative, if implemented, would have on maintaining the diversity of plant and animal communities and the persistence of native species on NFS lands.

The requirements in Alternative A directly address the issue of maintaining species diversity and species persistence within a planning area through a combined ecosystem (coarse-filter) and species-specific (fine-filter) strategy. There are recognized advantages to combining the two approaches, largely based on the premise that it is more feasible to design and manage for a set of desired ecological conditions than it is to plan for hundreds or thousands of species (Hunter 1990, Kaufmann et al. 1994). This approach is fundamentally different from the 1982 planning rule approach in that it explicitly focuses on sustaining the range of ecological conditions necessary to provide for species diversity using a coarse-filter and fine-filter strategy. This combined strategy is a well-developed concept in the scientific literature, and is generally supported by the science community for application on Federal lands. By maintaining or restoring desired ecological conditions at multiple spatial and temporal scales, the focus for maintaining viable populations of species is extended to all native plant and animal species, not just vertebrate species as was the focus under the 1982 planning rule.

The ecosystem diversity requirement in § 219.9 of this alternative mirrors the requirement provided under the ecological sustainability provisions of § 219.8. It does so to clearly establish the importance of ecosystem health and resilience through the maintenance or restoration of the structure, composition, function, and ecological connectivity of terrestrial and aquatic ecosystems in the plan area (see additional discussion of ecological integrity in the Ecosystem Restoration section previously presented in this chapter). This alternative recognizes that ecosystems are naturally dynamic and changing as a result of succession, disturbances, and other ecological processes. Species abundance and distribution are therefore also dynamic. See the previous discussion on Dynamic Nature of Ecosystems. Maintaining species composition matters because individual species play important functional roles in ecosystems by driving many critical ecological processes. Retaining the greatest proportion of the expected diversity within the plan area assists in maintaining high ecological integrity

and leads to greater primary productivity and resilience. See also the discussion of Ecological Integrity and Resilience presented earlier in this chapter.

For many species (fungi, aquatic invertebrates, insects, and many other species groups), minimal biological information on their life histories, status, abundance, and distribution exists. A community or ecosystem restoration and conservation approach is expected to be the best opportunity to conserve species for which life requirements and habitat relationships are largely unknown. This approach provides for analysis and management efficiency by addressing characteristics of ecosystem diversity (composition, structure, processes, and habitat connectivity and permeability) rather than hundreds or thousands of individual species. It is predicated upon an understanding of the historical range of variability and of historical system dynamics and resilience. This understanding of past ecological conditions places current and anticipated desired future conditions in the context of past ecosystem dynamics in order to establish a framework for ecosystem restoration, especially under changing conditions, such as climate change. See previous sections in this chapter on HRV and on Stressors and Their Influence, as well as the previous section on Ecosystem Restoration. As new and revised plans developed under this alternative are implemented, it is expected that many or most of the habitat requirements for most native species will be met through restoration activities that provide the ecological conditions consistent with a functioning coarse-filter. The ecosystem diversity requirement is consistent with accepted scientific literature on the coarse-filter approach, with the ecosystem approach described in the Endangered Species Act, and with the diversity of plant and animal communities principle enacted in NFMA.

Because the life requirements for some species may not be fully addressed under the coarse-filter approach alone, a complementary fine-filter approach may be needed to serve as a "safety net" for those species (Hunter 1990). The additional species-specific plan components requirement (§ 219.9) provides the complementary fine-filter approach to maintaining the biological diversity on each NFS unit. It is intended to identify specific ecological conditions for species with known conservation concerns for which there continues to be concern that their requisite ecological conditions will not be fully provided under the coarse-filter approach or over the timeframes required to provide adequate ecological conditions. This alternative specifically identifies the categories of at-risk species for which the fine-filter may be appropriate. These are species that are federally listed as threatened or endangered; species that are candidates for Federal listing, whose viability is a concern across their range and might require special management considerations to avoid potential Federal listing; and species whose viability or persistence within a particular plan area is a concern (species of conservation concern). The Species Conservation provisions under this alternative requires an evaluation of the ecological conditions provided under the ecosystem diversity (coarse-filter) requirements to determine whether they provide ecological conditions that sufficiently contribute to the recovery of federally listed threatened and endangered species, conserve proposed and candidates to Federal listing, and maintain the viability of identified species of conservation concern. Where the ecological conditions to be provided under the coarse-filter approach do not sufficiently address these at-risk species, additional species-specific plan components designed to do so would be included in the plan. This requirement essentially provides the fine-filter complement for species not conserved by

the coarse-filter approach. Species-specific plan components may be needed to more fully address potential stressors on these species, beyond vegetation composition and structure, which are under management control, such as human disturbance, road and trail placement, food storage, etc.

The provisions in the Sustainability and Diversity of Plant and Animal Communities sections (§§ 219.8 and 219.9) will require the development and revision of plans that include plan components that when implemented over time are expected to be proactive in the conservation of the federally recognized threatened, endangered, proposed, and candidate species, and Agency identified species of conservation concern in the plan areas. They are also expected to further the purposes of the Endangered Species Act (ESA), under Section 7(a)(1) of the ESA, by actively contributing to threatened and endangered (T&E) species recovery and maintaining or restoring the ecosystems upon which they depend. Additionally, the provisions required under this alternative that address the conservation of proposed and candidate species for Federal listing and other species of conservation concern provide a proactive strategy for preventing the need for Federal protection under the ESA for species occurring on NFS lands. For further discussion, see the Biological Assessment of the United States Department of Agriculture National Forest System Land Management Planning Rule for Federally Listed Endangered and Threatened Species, Species Proposed for Federal Listing, and Species that are Candidates for Federal Listing on National Forest System Lands.

Sections 219.8 and 219.9 under this alternative provide that required plan components designed to maintain or restore ecological conditions necessary for maintaining plant and animal diversity and the persistence of native species must be based on factors that are attainable within the authority and control of the Agency and within the inherent biophysical capability of the plan area, and not on stressors beyond Agency control (such as the effects of climate change, forest clearing in the Amazon region of South America, private land fragmentation and development, invasive species, disease, etc). This alternative recognizes that ecological conditions within a particular plan area might not fully address the viability for species whose range extends well beyond the plan area, but does require that plan components be included that are designed to contribute conditions that support viability of species across their range. In doing this, the responsible official is required to coordinate, to the extent practicable, with other land managers on conservation activities that contribute to this effort. Because many species within the plan area are dependent on habitat both on and off NFS lands, and may spend a significant part of the year or of their life cycles outside NFS boundaries, this increased collaboration and coordination with other Federal agencies, States, Tribes, and interested stakeholders should provide a more coordinated effort and more timely information with which to address species conservation concerns in the future.

The planning framework in Alternative A requires a collaborative and scientifically based process to assess differences between existing conditions and desired ecological conditions when establishing desired ecological conditions needed to support the diversity of plant and animal communities and the persistence of native species within the plan area. This alternative's requirements for public engagement throughout the assessment, planning, and monitoring aspects of land management planning are expected

to facilitate collaboration and coordination with other land management agencies, organizations, and entities within the broader landscape. As a result of close coordination with neighboring land managers, the Agency's planning process is intended to more fully address the needs of specific species. This coordination should also facilitate ecological connectivity strategies at the broader landscape level that provides linkages within home ranges, facilitates genetic interchange, and allows long-distance range shifts of species, such as in response to climate change.

Therefore, under Alternative A,

- All plans would incorporate a complementary coarse-filter and fine-filter strategy (§ 219.9) to maintain biological diversity within the plan area. This approach is more scientifically credible and supportable in maintaining biological diversity than was required under the 1982 planning rule; and considers all native species, rather than focusing on vertebrates only. As plans are implemented under these provisions, NFS lands are expected to more consistently provide the ecological conditions necessary to maintain the diversity of plant and animal communities and the persistence of native species than under the No Action alternative (Alternative B).
- Plans would emphasize ecological restoration and connectivity and, where necessary, provide species-specific plan components focused on at-risk species, which include federally listed, proposed, and candidate species, and species of conservation concern (§ 219.9). As these plans are implemented, ecological conditions for many federally listed species, species proposed and candidates for listing, and species of conservation concern are expected to improve within and among plan areas. It is also expected that the abundance and distribution of many of these species will also improve within the plan area over time.
- Planning would involve, to the extent practicable, other land managers (§ 219.9) for species of conservation concern whose range and long-term viability are associated with lands beyond the plan area. This coordination should lead to more effective collaborative approaches to addressing the rangewide concerns of these species.
- Responsible officials would actively engage in a collaborative, all-lands approach to maintaining biological diversity. This approach could present the best opportunity for recovering threatened and endangered species, preventing the listing of candidates to Federal listing, and conserving species of conservation concern.

Managing Ecological (Habitat) Conditions

Effects on Plan Content and the Planning Process

Sections 219.8-Sustainability and 219.9-Diversity of Plant and Animal Communities of Alternative A set forth requirements relevant to maintaining species diversity and managing ecological (habitat) conditions on national forests and grasslands.

The rule requirements in this alternative that are relevant to this indicator are the same as those provided under Maintaining Species Diversity and Population Viability above.

Effects on Resources Expressed as General Outcomes Over Time

Based on the effects on plan content and the planning process previously provided, the information and context specific to this issue provided in the Affected Environment for this section, and the scientific overview provided under the Dynamic Nature of Ecosystems section presented earlier in Chapter 3, the following statements can be made relevant to the effects that this alternative, if implemented, would have on managing ecological conditions needed to support the diversity of plant and animal communities and the persistence of native species on NFS lands.

Under Alternative A, an assessment (§ 219.6) of the existing and potential future ecological conditions and stressors within the plan area would be conducted to provide information for the development of plan components required by the Sustainability and Diversity sections of the alternative. This assessment would identify the ecological conditions needed to support the native species within the plan area. This alternative then requires plan components—i.e., desired conditions, objectives, suitability of areas, standards, and guidelines (§ 219.7)—for maintaining or restoring these key ecosystem components related to composition, structure, function, and connectivity necessary to maintain or improve the ecological integrity of terrestrial and aquatic ecosystems within the plan area. This alternative focuses on providing ecological conditions—factors directly under Forest Service authority and control, including vegetation, aquatic and terrestrial habitat, roads, structures, facilities, and public use—rather than on the actual individuals or populations of species.

There are two primary reasons for focusing on ecological conditions. First, the Agency is capable of maintaining or restoring ecological conditions, such as late seral ponderosa pine forests for northern goshawks, but it cannot guarantee or compel goshawks to occupy the habitat. Second, factors beyond Agency control might affect actual population size or occupation of available habitat independent of the existing ecological conditions provided (e.g., weather, disease, climate change, competition, or broad-scale population declines). The provisions under this alternative require plan components designed to provide the suite of habitats, at a variety of scales, which are informed by those provided throughout the plan area's ecological history (see also the discussion of Historical Range of Variability as a Way of Understanding the Historical Nature of Ecosystems and Their Variation presented earlier in this chapter). Additional plan components would be required, where necessary, to provide for specific habitat features or habitat effectiveness needed to contribute to recovery of federally listed species, to conserve proposed and candidate species, and to maintain viable populations of species of conservation concern.

Required plan components needed to maintain or restore the ecological conditions associated with ecosystem health and resilience are expected to be informed by a variety of the best available scientific and ecological information. Examples of the types of information to be considered include the historical range of variation, the representativeness of ecosystem types, an understanding of possible stressors, the

inherent ecological capability of the area, biotic integrity, and existing and projected climate envelopes.

The specific requirement (§ 219.8) that plans must include plan components to maintain or restore riparian areas would provide additional emphasis and protection to these areas which are very important habitats. Riparian areas provide important corridors for species to move throughout the landscape, conditions for maintaining water quality and flows, and habitats for a wide variety of species, especially aquatic and riparian associates.

Therefore, under Alternative A,

- Planning would assess key ecosystem characteristics (§ 219.6) of terrestrial and aquatic ecosystems within the plan area and would develop specific plan components that focus management actions on maintaining and restoring ecological conditions, including connectivity, that maintain or improve the ecological integrity of these ecosystems (§§ 219.8 and 219.9). Over time, as management activities are implemented to achieve the desired ecological conditions, habitat quantity is expected to increase and habitat quality is expected to improve for most native species across the NFS.
- Plans would include specific restoration measures for riparian areas (§ 219.8). The implementation of these components is expected to result in improved streamside, wetland, lakeside, and aquatic habitats, especially for aquatic and riparian species.

Monitoring to Assess Effectiveness

Effects on Plan Content and the Planning Process

Section 219.12 of Alternative A sets forth requirements relevant to monitoring and assessing the effectiveness of the plan components in achieving the ecological conditions for maintaining the diversity of plant and animal communities and the persistence of native species on national forests and grasslands.

In terms of monitoring species diversity, rule language in this alternative specifically requires:

- That monitoring provide continuous feedback for the planning cycle by testing relevant assumptions, tracking relevant conditions over time, and measuring management effectiveness (§ 219.5).
- That the responsible official identify questions and indicators for the plan monitoring program; and that plans include a monitoring program (§ 219.7).
- That the plan monitoring program includes monitoring at both unit and broad-scale levels to ensure that monitoring is complementary and efficient, and that information is gathered at scales appropriate to the monitoring questions (§ 219.12).

- Taking into account the best available scientific information when designing monitoring programs and protocols (§ 219.12).
- That each plan monitoring program monitor the status of select watershed conditions; status of select ecological conditions; and status of focal species to assess the ecological conditions (§ 219.12).

Effects on Resources Expressed as General Outcomes Over Time

Based on the effects of this alternative on plan content and the planning process provided above, the information and context specific to this issue provided in the Affected Environment for this section, and the scientific overview provided under the Dynamic Nature of Ecosystems section presented earlier in Chapter 3, the following statements can be regarding the effects that this alternative, if implemented, would have on monitoring the ecological conditions needed to support the diversity of plant and animal communities and the persistence on native species on NFS lands.

Section 219.12-Monitoring in Alternative A requires monitoring questions that directly address the status of ecological conditions along with the status of focal species to assess the degree to which ecological conditions are supporting diversity of plant and animal communities, species of conservation concern, and ecosystem diversity within the plan area, and measurable changes on the unit related to climate change and other stressors on the unit. Monitoring for species diversity under Alternative A does not rely on establishing a species population trend in order to infer relationships between population trends and habitat changes. Rather, this alternative relies primarily on monitoring and assessing measurable ecological conditions (compositional, structural, and functional) related to desired ecological conditions, and focal species that are selected to assess progress towards meeting desired conditions and the effectiveness of those conditions for achieving ecological objectives. Monitoring for ecosystem and species diversity focuses on whether plan components are being implemented properly and whether the unit is making progress toward achieving its desired ecological conditions.

This alternative requires two spatial scales of monitoring, one at the plan area level and one at a broader scale. This two-tiered approach to monitoring is expected to be effective at matching the appropriate scale to the monitoring question to be answered. Broader-scale monitoring may be the more appropriate scale to monitor species that are wide-ranging, migratory, or occur across multiple NFS units. Plan area monitoring may be more appropriate for species that are unique to a particular NFS unit; and for measuring and monitoring ecological conditions within the plan area, relevant to plan implementation.

Focal species are not specifically intended to directly indicate effects of management activities on other species associated with the same or similar habitats, nor are they species for which there is necessarily a specific conservation requirement. Rather, they are selected to provide insight into the integrity of the larger ecological system to which they belong, to assess the effects of management and other stressors on those ecological conditions, and to provide meaningful information regarding the effectiveness of the plan in maintaining the diversity of plant and animal communities in the plan area. Focal species would be commonly selected on the basis of their functional role in ecosystems.

Consideration for the selection of a set of focal species could include: the number and extent of relevant ecosystems in the plan area; the primary threats or stressors to those ecosystems, especially those related to predominant management activities on the plan area; the sensitivity of the species to changing conditions or their utility in confirming the existence of desired ecological conditions; the broad monitoring questions to be answered; factors that limit viability of species; and others. Monitoring methods for evaluating the status of focal species could include measures of abundance, distribution, reproduction, presence/absence, area occupied, survival rates, and others. While some or all of these measurements can be used to evaluate species population characteristics, this alternative does not require the establishment of a population trend of a focal species to assess and evaluate the integrity of the relevant desired ecological conditions. Monitoring program, including the selection of focal species, would be developed in conjunction with research entities and would utilize the best available scientific information to ensure a science tie between monitoring methods and the question to be answered.

The concept of MIS is not included in Alternative A because scientific evidence has identified potential flaws in the MIS concept, or in its application.

The emphasis on the role of science (§ 219.3), the expanded public participation, collaboration, and coordination process (§ 219.4), and the two-tiered monitoring strategy (unit- and broad-scale under § 219.12) required under this alternative is expected to enhance the Agency's ability to: gather and assess information beyond the border of the plan area and at appropriate ecological scales; adjust management; and contribute to broader species conservation and recovery plans, actions, and monitoring efforts.

Therefore, under Alternative A,

- Plans would include ecological monitoring elements (ecological conditions and focal species) (§ 219.12) that would be broader in scope than the MIS monitoring requirement in the 1982 planning rule, and are expected to be more effective and efficient at assessing the diversity of plant and animal communities and persistence of native species within the plan area. Reliable information from this monitoring would be expected to identify the need to amend or revise a plan or alter management approaches and activities in a timelier manner than monitoring under the 1982 planning rule.
- Planning would establish a two-tiered approach to monitoring, at the unit scale and at a broader scale (§ 219.12); emphasize collaboration and coordination (§ 219.4); and increase the role of science (§ 219.3) over that required under the 1982 planning rule. These procedures and processes facilitate the gathering, assessment, and incorporation of information beyond national forest and grassland boundaries, which should lead to more consistent and effective approaches to the conservation of all species within the broader region beyond the plan area than the approach taken under the 1982 rule.

Modified Alternative A Effects

The effects of this alternative are largely the same as Alternative A, with the following exceptions:

The clarifications made to the rule language of Alternative A as well as the additional detail regarding the planning process may result in more consistent interpretation and implementation of the provisions in §§ 219.8, 219.9, and 219.12 than under Alternative A.

The requirements for ecosystem diversity were modified in § 219.9 to specifically underscore the importance of maintaining or restoring the diversity of ecosystems throughout the plan area and the key characteristics associated with terrestrial and aquatic ecosystem elements. Providing the diversity of habitat conditions throughout the plan area is expected to allow for a distribution of individuals or local populations to occupy suitable habitat conditions across the plan area and minimize the possibility for a single local population decline to cause an extirpation from the plan area.

Under this alternative, the regional forester will identify the species of conservation concern. This should increase efficiency in planning, compared with Alternative A, and ensure consistency of method and promote efficiency in how these species will be identified between and among national forests and grasslands within a region. Additionally, because the broader-scale monitoring strategy would be developed by the regional forester, monitoring programs that assess the ecological conditions needed to support species of conservation concern may be more efficient and effective if the rationale for identification were clearly linked to monitoring.

Plans would include a monitoring element that specifically addresses the status of ecological conditions, including key ecosystem characteristics, that contribute to the recovery of federally listed threatened and endangered species, conserve proposed and candidate species, and maintain a viable population of each species of conservation concern within the plan area (§ 219.9). This monitoring question and associated indicator places additional emphasis on moving desired ecological conditions towards those needed to support species that are most vulnerable within the plan area.

Alternative B Effects

Maintaining Species Diversity and Population Viability

Effects on Plan Content and the Planning Process

Sections 219.19-Fish and Wildlife Resource, 219.26-Diversity, and 219.27-Management Requirements of Alternative B set forth requirements relevant to maintaining species diversity and managing ecological (habitat) conditions on national forests and grasslands. A primary goal of § 219.19 is to manage habitat that maintains viable populations of existing native and desired non-native vertebrate species in the plan area. This is to be achieved largely through the selection of, habitat management for, and monitoring of selected MIS. The provisions of §§ 219.26 and 219.27 require forest plans to provide for the diversity of plant and animal communities consistent with multiple-use objectives.

In terms of maintaining species diversity, rule language in this alternative specifically requires:

- A review of other government agency(s) planning and land use policies and consideration of objectives in those plans and policies.
- Provisions to manage habitat conditions that maintain the viability of all native and desired non-native vertebrate species (§§ 219.19 and 219.27).
- Measures for preventing the destruction or adverse modification of critical habitat for threatened and endangered species (§ 219.27).
- Specific requirement for management prescriptions to preserve and enhance the diversity of plant and animal communities based on the diversity of what would be expected in a natural forest or one similar to the existing diversity (§ 219.27).

This alternative does not include monitoring requirements specific to maintaining or restoring ecological conditions.

Effects on Resources Expressed as General Outcomes Over Time

Based on the effects on plan content and the planning process provided above, the information and context specific to this issue provided in the Affected Environment for this section, and the scientific overview provided under the Dynamic Nature of Ecosystems section presented earlier in Chapter 3, the following statements can be made relevant to the effects that this alternative, if implemented, would have on maintaining the diversity of plant and animal communities and the persistence of native species on NFS lands.

Under Alternative B (the 1982 rule), the requirement to manage habitat to ensure species viability is specific to native and desired non-native vertebrates only, although some later generation plans do attempt to address viability for all plant and animal species within the plan area. The ability of the Agency to ensure [a vertebrate species'] continued existence is well-distributed in the planning area as required under the 1982 planning rule is problematic, especially for federally listed threatened or endangered species. These are species that are in danger of extinction throughout all or a significant portion of their range now or in the foreseeable future. Based on available scientific information and existing conditions throughout a species range, these are species whose populations may no longer be viable and whose recovery, in most cases, cannot be achieved on a single NFS plan area, for reasons independent of the amount or quality of habitat in the plan area. The Puerto Rican parrot, woodland caribou, steelhead trout, or desert tortoise are examples of such threatened and endangered species.

For assessing vertebrate species viability, the 1982 rule is largely reliant on the ability of selected MIS and their associated habitat conditions to adequately represent all other vertebrates in the plan area. Even though the process of assessing and selecting MIS has evolved, the ability of a species or species group, on its own, to adequately represent all associated species that rely on similar habitat conditions is largely unsupported in the scientific literature. While approaches similar to the coarse-filter and fine-filter strategy have been incorporated into some of the recently revised plans, it is not explicitly spelled out in the 1982 rule language and considerable variability exists among current plans as

to how they address the issue of maintaining biological diversity within their respective plan areas.

Following the 1982 planning rule, the Agency adopted directives that required national forests and grasslands to recommend to their regional foresters those species whose viability was a concern rangewide or within the plan area. These species were subsequently listed as regional forester sensitive species; a concept similar to what Alternative A refers to as species of conservation concern. The directives required that an analysis of the potential effects on these species as a result of an Agency decision be conducted and documented in a biological evaluation. Many plans incorporated components that maintained or protected species occurrences or habitat conditions.

The provisions of this alternative require identification of critical habitat for federally listed species and plan objectives that provide for conservation actions that contribute to recovery plans and the eventual delisting of those species. Plan components for conservation or recovery actions are consistently included in the development or revision of plans, and national forests and grasslands continue to contribute to the recovery of threatened and endangered species.

The requirements for public engagement in the planning process under this alternative could facilitate collaboration and coordination with other land management agencies, organizations, and entities within the broader landscape.

Therefore, under Alternative B:

- Plans would rely primarily on selected MIS as a way to assess the effects of management activities on other species or habitats, and would focus on managing for their habitat conditions and monitoring their population trends. Because the species viability requirement is limited to managing habitat to ensure viable populations only of native and desired nonnative vertebrates, plans may not fully address the life requirements of invertebrates and plants. As plans are developed and implemented under these provisions, NFS lands are expected to vary in the extent to which they provide the ecological conditions necessary to maintain the diversity of plant and animal communities and the persistence of native species.
- Plans would continue to provide explicit fish and wildlife conservation language, which has benefitted these resources in the past. This would be expected to continue as plans are developed and revised under this rule.
- There is more discretion provided to the responsible official with respect to collaborating and coordinating with other agencies and entities, and to taking a broader approach to gathering, assessing, and using other relevant information. Plans would vary in the use of this information when addressing species viability issues that extend beyond national forest and grassland boundaries and their approaches to the conservation of all species within the region of a plan.

Managing Ecological (Habitat) Conditions

Effects on Plan Content and the Planning Process

Sections 219.19-Fish and Wildlife Resource, 219.26-Diversity, and 219.27-Management Requirements of Alternative B set forth requirements relevant to maintaining species diversity and managing ecological (habitat) conditions on national forests and grasslands.

The rule requirements in this alternative that are relevant to this indicator are the same as those discussed under Maintaining Species Diversity above.

Effects on Resources Expressed as General Outcomes Over Time

Based on the effects on plan content and the planning process provided above, the information and context specific to this issue provided in the Affected Environment for this section, and the scientific overview provided under the Dynamic Nature of Ecosystems section presented earlier in Chapter 3, the following statements can be made relevant to the effects that this alternative, if implemented, would have on managing ecological conditions needed to support the diversity of plant and animal communities and the persistence on native species on NFS lands.

Under the provisions of the 1982 rule, habitat is assessed and managed to maintain viable populations of existing native and desired non-native vertebrate species within the plan area; and is largely focused upon the life requirements of selected MIS. Detected changes to their population trends are used to determine habitat effectiveness and assurance of viability for other associated species. The ability to detect changes in population trends for MIS within the life of a plan is often extremely difficult. The inability of the Agency to detect changes in MIS population trends compounds the difficulty of relating population trends to overall habitat conditions and potential adjustments to management activities that might be altering those conditions. Relying on species (MIS) monitoring alone is problematic for assessing the viability of other habitat associates.

Therefore, under Alternative B, plans would continue to provide management direction for habitat management based upon the needs of selected MIS. Many MIS have not been biologically appropriate for representing other habitat associates, and do not explicitly address key ecosystem characteristics (composition, structure, function, and landscape connectivity) needed to maintain ecological conditions for all native species. As plans are developed and implemented under these provisions, overall habitat management approaches on NFS lands are expected to continue to be variable among plan areas.

Monitoring to Assess Effectiveness

Effects on Plan Content and the Planning Process

Section 219.19 Fish and Wildlife Resource of this alternative provides the monitoring requirement related to maintaining species diversity.

In terms of monitoring species diversity, rule language in this alternative specifically requires:

- Monitoring of population trends of MIS and relationships to habitat changes determined. This is to be done in cooperation with State fish and wildlife agencies.

Effects on Resources Expressed as General Outcomes Over Time

Based on the effects on plan content and the planning process provided above, the information and context specific to this issue provided in the Affected Environment for this section, and the scientific overview provided under the Dynamic Nature of Ecosystems section presented earlier in Chapter 3, the following statements can be made relevant to the effects that this alternative, if implemented, would have on monitoring the ecological conditions needed to support the diversity of plant and animal communities and the persistence on native species on NFS lands.

Section 219.19 Fish and Wildlife Resource in the 1982 planning rule sets forth requirements relevant to monitoring fish and wildlife populations and habitat conditions on national forests and grasslands.

Under the 1982 provisions, certain vertebrate, invertebrate, and/or plant species present in the area are to be identified and selected as management indicator species because their population changes are believed to indicate the effects of management activities on fish and wildlife resources. Monitoring of MIS habitat and population trend provides the data for this evaluation process. Habitat monitoring is relatively well-understood and practical to accomplish for many species; however, population trend monitoring can be a complex and expensive endeavor. Efficient, statistically valid methods are lacking for many species. Since the 1982 planning regulations acknowledge a strong tie between many vertebrate populations and habitat, the Agency interpreted the regulations as providing the option to monitor habitat relationships in lieu of direct population trends. Frequently, habitat monitoring has been the approach used for wildlife species that are difficult to detect, or for those who do not have established protocols for population monitoring. Recent court rulings differ in their interpretations of the MIS monitoring requirement, but in several cases they have highlighted the importance of monitoring population trends of MIS in land management plan implementation. Changes in habitat conditions and population trend function together as indicators of ecological change. In many cases, making inferences regarding the consequences of management would be difficult without the complementary lines of evidence contained in habitat trend and population trend information (Hayward et al. 2004).

The use of MIS as required under the 1982 planning rule serves a wide range of purposes. Some categories of MIS have been effectively used for displaying effects of management on some categories of species, such as those that are commonly hunted, fished, or trapped and those that are federally listed. However, one major use of a selected MIS has been to use it as a surrogate to indicate effects on other species with similar habitat requirements from plan implementation. The use of MIS has achieved mixed success and drawn heavy criticism, largely because monitoring the population trend of one species should not be extrapolated to form conclusions regarding the status and trends of other species. There is a body of scientific evidence identifying flaws in the MIS concept, or in its application, for assessing the effectiveness of plan implementation on maintaining viable populations

of species within the plan area, or determining the effects of management on associated species. Experience has demonstrated that statistically adequate population trend information generally requires many years (10 to 20+ years) over large scales (100s to 1,000s of square miles) and has only been accomplished for a limited number of species (such as northern spotted owl, grizzly bear, and red-cockaded woodpecker). It is impractical to include species population trend monitoring in a plan because of the time and resources required to determine trends and the inherent difficulty to infer a cause-and-effect relationship between species population trends and habitat relationships. For these reasons, the use of MIS population trends as a signal for amending or revising plan components is impractical, and often scientifically unjustified.

Therefore, under Alternative B, plans would continue to rely on establishing population trends of selected MIS as a way to assess vertebrate species viability. This is expected to continue the inconsistency in a forest or grassland's ability to assess the viability of all native species within the plan area. Additionally, the correlation between the population trend of a MIS and the trends in habitat conditions or population trends for other associated species, in many cases, may be scientifically unsupportable.

Alternative C Effects

Maintaining Species Diversity and Population Viability

Effects on Plan Content and the Planning Process

Alternative C removes requirements that are not specifically required by NFMA, except those needed to address the purpose and need for a new planning rule. The purpose and need states that a new planning rule is needed to be responsive to the challenges of climate change and the need for forest and grassland restoration.

In terms of maintaining species diversity, rule language in this alternative specifically requires plan components designed to provide for diversity of plant and animal communities based upon the suitability and capability of the land area in order to meet multiple-use objectives; and requires plan components designed to maintain or restore terrestrial and aquatic ecosystems and watersheds in the plan area. Inclusion of plan components to provide for viability would be left to the discretion of the responsible official unless included in the directives.

Effects on Resources Expressed as General Outcomes Over Time

Based on the effects on plan content and the planning process provided above, the information and context specific to this issue provided in the Affected Environment for this section, and the scientific overview provided under the Dynamic Nature of Ecosystems section presented earlier in Chapter 3, the following statements can be made relevant to the effects that this alternative would have on maintaining the diversity of plant and animal communities and the persistence of native species on NFS lands.

Alternative C is intentionally designed to be non-prescriptive. Therefore, the flexibility provided by this alternative could increase efficiency and allow opportunity for units to tailor assessment, revision or amendment, and monitoring to address only the critical or

unique needs of the unit. However, there would also be much greater uncertainty as to how the diversity of plant and animal communities and the persistence of native species not specifically required by the alternative would be considered and included in plan revision or amendment than under the other alternatives.

The diversity of plant and animal communities provisions under this alternative do not provide explicit requirements for plan components necessary to implement the NFMA statutory requirement for maintaining diversity of plant and animal communities. It provides no specific requirements for maintaining viable populations of species within the plan area or for contributing to the recovery of threatened and endangered species. The interpretation of how to meet the NFMA diversity requirement would be made at the planning unit level, and plan components included in future plans would likely vary in the extent to which they effectively maintain species viability within the plan area.

There are no requirements in Alternative C for the Agency to document the manner in which to assure that scientific information has been appropriately interpreted and applied. Although based on recent plan revisions, there is no reason to expect that scientific information would not be used to develop and monitor plans, but the degree and the extent of such documentation would vary.

Similar to Alternative A and Modified Alternative A, land management planning in Alternative C requires a collaborative-based and participatory process during the planning process. This is expected to facilitate collaboration and coordination with other land management agencies, organizations, and entities within the broader landscape.

Specific direction for how plans would be developed and what content would be required would primarily be found in Agency directives.

Therefore, under Alternative C, there would be considerable discretion for addressing the diversity of plant and animal communities and species diversity because there are no specific requirements for how this NFMA requirement is to be met, and would be relatively open to the discretion of the responsible official. Plans developed and implemented under these provisions are expected to vary considerably in their approaches. Given the lack of requirements for viability, there is no guarantee of any effort to maintain viability. Overall, plans are expected to vary considerably in their approaches to providing for diversity of plant and animal communities, which could lead to greater uncertainty regarding species diversity and persistence on all NFS lands.

Managing Ecological (Habitat) Conditions

Effects on Plan Content and the Planning Process

Sections 219.8 Sustainability and 219.9 Diversity of Plant and Animal Communities of Alternative C set forth requirements relevant to maintaining species diversity and managing ecological (habitat) conditions on national forests and grasslands.

In terms of managing ecological conditions to maintain species diversity, rule language in this alternative specifically requires plan components designed to provide for diversity of

plant and animal communities, and to maintain or restore terrestrial and aquatic ecosystems and watersheds in the plan area (§ 219.8).

Effects on Resources Expressed as General Outcomes Over Time

Based on the effects on plan content and the planning process provided above, the information and context specific to this issue provided in the Affected Environment for this section, and the scientific overview provided under the Dynamic Nature of Ecosystems section presented earlier in Chapter 3, the following statements can be made relevant to the effects that this alternative, if implemented, would have on managing ecological conditions for maintaining the diversity of plant and animal communities and the persistence of native species on NFS lands.

There are no explicit habitat management requirements provided in this alternative. There is a timber requirement (§ 219.11) for ensuring that fish and wildlife are protected during even-aged regeneration timber harvests. The focus of habitat management activities is expected to vary among planning units across the NFS. Specific direction for how plans would meet the two requirements in §§ 219.8 and 219.9 would primarily be found in Agency directives.

Therefore, under Alternative C,

- Plans developed and implemented under these provisions are expected to vary considerably across the NFS with regard to habitat management and the ability for plan areas to provide the ecological conditions necessary to maintain the diversity of plant and animal communities and the persistence of native species.
- Forest Service directives and policy would provide primary direction on how plans are to be developed or revised when it comes to providing diversity of plant and animal communities. This could lead to broader interpretations of what plans must contain and to inconsistencies from one unit to another as to how species diversity is to be maintained within a plan area.

Monitoring to Assess Effectiveness

Effects on Plan Content and the Planning Process

Section 219.12 Monitoring of Alternative C sets forth requirements relevant to monitoring. This alternative provides no specific requirements related to monitoring species diversity.

Effects on Resources Expressed as General Outcomes Over Time

Based on the effects on plan content and the planning process provided above, the information and context specific to this issue provided in the Affected Environment for this section, and the scientific overview provided under the Dynamic Nature of Ecosystems section presented earlier in Chapter 3, the following statements can be made relevant to the effects that this alternative would have on monitoring the diversity of plant and animal communities and the persistence of native species on NFS lands.

Again, there are no specific requirements for what is to be included in a unit's plan monitoring program. This would be expected to lead to inconsistency in what monitoring elements would be included in plans and how the selected elements would relate to assessing species viability and habitat conditions across the plan area.

Therefore, under Alternative C, there would be considerable discretion on what would be in monitoring plans. Plans developed and implemented under these provisions are expected to vary considerably in their monitoring approaches for assessing the effectiveness of plan components necessary to provide the ecological conditions to maintain the diversity of plant and animal communities. The responsible official would have more discretion with respect to collaborating and coordinating with other agencies and entities, and to gathering, assessing and utilizing other relevant information. This could lead to inconsistent use of this information if, or when, addressing species viability issues that extend beyond national forest and grassland boundaries and could lead to less effective approaches to the conservation of all species within the region of a plan.

Alternative D Effects

Maintaining Species Diversity and Population Viability

Effects on Plan Content and the Planning Process

Alternative D would be expected to have similar effects on plans as those described for Alternative A. Provisions under § 219.9 of this alternative require a complementary ecosystem and species-specific approach to maintaining the diversity of plant and animal communities in the plan area. The effects on maintaining species diversity within the plan area are expected to be similar to those disclosed under Alternative A. However, Alternative D adds some additional requirements for the planning process and plan content specifically related to maintaining species diversity, including:

- An increased emphasis on coordination across multiple planning units for species viability, in plan development, assessment, and monitoring; and increased interagency coordination of the management of planning areas at the landscape level (§ 219.4).
- Watershed scale assessments that include climate change vulnerability (§ 219.6).
- Additional emphasis on key watersheds within the plan area and spatial connectivity between watersheds (§ 219.8).
- Standards and guidelines for:
  - Protection, maintenance, and restoration of riparian conservation areas.
  - Connectivity of watersheds across the planning unit.
  - Road removal and remediation in key watersheds and riparian conservation areas as the top restoration priority (§ 219.8(a)(4)(vi)).

Effects on Resources Expressed as General Outcomes Over Time

Based on the effects on plan content and the planning process provided above, the information and context specific to this issue provided in the Affected Environment for this section, and the scientific overview provided under the Dynamic Nature of Ecosystems section presented earlier in Chapter 3, the following statements can be made relevant to the effects that this alternative would have on maintaining the diversity of plant and animal communities and the persistence of native species on NFS lands.

The species viability provisions proposed under this alternative are more focused on a species-by-species (fine-filter) approach to maintaining viable populations of all species within the plan area than species viability provisions under Alternative A. They also provide more specific, explicit requirements for coordination, assessments, ecological connectivity, and road decommissioning. These additional requirements would serve to further reduce variability as to how these particular resources would be addressed from that provided in Alternative A. Another difference between this alternative and Alternative A is that Alternative A includes specific requirements that plans include provisions for plan components that contribute to the recovery of federally listed species. Such a requirement is only implied under Alternative D.

This alternative includes an extrinsic conditions requirement, which mandates that the responsible official disclose those species for which circumstances beyond the Agency's control would cause its extirpation from the plan area. An example is a small isolated population of white-tailed ptarmigan where, because of changing climatic conditions on the southern end of its range, a plan area may no longer be capable of providing the necessary habitat conditions they require to persist. This would likely have minimal if any effect on the actual persistence of a species, but is expected to inform the public of the rationale used to come to this determination.

Therefore, under Alternative D,

- Plans would incorporate a complementary coarse-filter and fine-filter strategy (§ 219.9) to conserve biological diversity within the plan area; emphasize ecological restoration and connectivity; and incorporate additional species-specific plan components focused on species viability. In terms of species diversity and viability, there would be similar effects to those disclosed under Alternative A (proposed action).
- Similar to Alternative A, yet more explicit with respect to maintaining species diversity, planning would require close coordination with other land managers for species whose range and long-term viability is associated with lands beyond the plan area. This coordination should lead to more effective, collaborative approaches to addressing the rangewide concerns of these species than other alternatives.
- The explicit requirements related to ecological connectivity would further reduce any inconsistency in addressing this important aspect to maintaining species diversity. This could result in higher levels of connectivity and attendant benefits to species that are dependent on connectivity.

Managing Ecological (Habitat) Conditions

Effects on Plan Content and the Planning Process

Sections 219.8 Sustainability and 219.9 Diversity of Plant and Animal Communities of Alternative D set forth requirements relevant to maintaining species diversity and managing ecological (habitat) conditions on national forests and grasslands.

The rule requirements in this alternative that are relevant to this indicator are the same as those provided under Maintaining Species Diversity above.

Effects on Resources Expressed as General Outcomes Over Time

Based on the effects on plan content and the planning process provided above, the information and context specific to this issue provided in the Affected Environment for this section, and the scientific overview provided under the Dynamic Nature of Ecosystems section presented earlier in Chapter 3, the following statements can be made relevant to the effects that this alternative, if implemented, would have on managing ecological conditions for maintaining the diversity of plant and animal communities and the persistence of native species on NFS lands.

Section 219.8 Sustainability in this alternative sets forth specific requirements, additional to those in Alternative A, for protection, maintenance, or restoration of the structure, composition, processes, and connectivity of terrestrial and aquatic ecosystems within the plan area. These additional provisions explicitly require plan components to specifically address resources affecting: water quantity, quality, and flow; riparian area conservation; aquatic habitat quality; and landscape connectivity.

The inclusion of these watershed requirements would add additional emphasis that is expected to benefit aquatic and riparian resources. While requiring some or all of these plan components may be implied under the rule language proposed in Alternative A, they are explicitly required under this alternative and would provide stronger assurances to maintaining diversity, viability, and quality habitat conditions for those species associated with aquatic and riparian ecosystems.

Therefore, under Alternative D, plans would add requirements specific to watershed and riparian protection and restoration that would be expected to result in greater emphasis placed on ecosystem restoration within priority watersheds (§ 219.8). See the previous section on Watershed Protection for further discussions of this issue. Over time, as new planning requirements are implemented, the resulting plan areas are expected to yield habitat benefits, especially for aquatic and riparian species. Plans would add specific requirements for assessment (§ 219.6) of ecosystem diversity characteristics, which would be expected to result in greater assurances that an effective coarse-filter for maintaining biological diversity would be designed. Over time, as management activities are implemented to achieve the desired ecological conditions, habitat quantity is expected to increase and habitat quality is expected to improve for most native species across the NFS.

Monitoring to Assess Effectiveness

Effects on Plan Content and the Planning Process

Section 219.12 Monitoring of Alternative D sets forth requirements relevant to monitoring and assessing the effectiveness of the plan components in achieving the ecological conditions for maintaining the diversity of plant and animal communities and the persistence of native species on national forests and grasslands. These monitoring requirements are similar to those provided in Alternative A, except that this alternative adds a requirement and further clarification and specificity for monitoring the effectiveness of desired ecological conditions, including the establishment of critical values to trigger reviews of planning and management decisions.

Effects on Resources Expressed as General Outcomes Over Time

Based on the effects on plan content and the planning process provided above, the information and context specific to this issue provided in the Affected Environment for this section, and the scientific overview provided under the Dynamic Nature of Ecosystems section presented earlier in Chapter 3, the following statements can be made relevant to the effects that this alternative, if implemented, would have on monitoring the ecological conditions needed to support the diversity of plant and animal communities and the persistence on native species on NFS lands.

Section 219.12 Monitoring in this alternative sets forth requirements relevant to monitoring ecological conditions on national forests and grasslands. Similar to monitoring requirements in Alternative A, monitoring requirements under this alternative rely on the status and trends of ecological conditions and those of focal species to assess the degree to which the ecological conditions within the plan area are supporting a diversity of plant and animal communities and the persistence of native species. Monitoring under this alternative would focus more on the focal species aspects of the requirements rather than on key ecosystem characteristics. Compared to the monitoring program under Alternative A, this alternative relies more heavily on population surveys of focal species as the primary measurement for assessing overall effectiveness of plan components for supporting species diversity.

Under this alternative, the responsible official would also establish critical values for ecological conditions and focal species to trigger review of planning and management decisions. This alternative does not require the responsible official to include a broad-scale monitoring component in the overall monitoring strategy to address monitoring questions best answered at scales beyond the plan area. However, it does include more specific collaboration and coordination requirements. These requirements would be expected to enhance the Agency's ability to: gather and assess information beyond the border of the plan area and at more appropriate ecological scales; anticipate potential population declines; adjust management; and contribute to broader species conservation and recovery plans, actions, and monitoring efforts.

Therefore, under Alternative D, plans would include ecological monitoring elements (ecological conditions, ecosystem characteristics, and focal species) that are expected to

be more effective and efficient than those under the 1982 planning rule at assessing the diversity of plant and animal communities and species viability for all species within the plan area. Reliable information from this monitoring would be expected to identify the need to change either a plan or management activities in a more timely manner than under the 1982 rule. The addition of critical values to trigger reviews of plan components or project activities may further facilitate adaptive management strategies.

Alternative E Effects

Maintaining Species Diversity and Population Viability

Effects on Plan Content and the Planning Process

Alternative E would be expected to have similar effects on plans as those described for Alternative A. Provisions under § 219.9 of this alternative require a complementary ecosystem and species-specific approach to maintaining the diversity of plant and animal communities in the plan area. The effects on maintaining species diversity within the plan area are similar to those disclosed under Alternative A.

Effects on Resources Expressed as General Outcomes Over Time

Based on the effects on plan content and the planning process provided above, the information and context specific to this issue provided in the Affected Environment for this section, and the scientific overview provided under the Dynamic Nature of Ecosystems section presented earlier in Chapter 3, the following statements can be made relevant to the effects that this alternative, if implemented, would have on maintaining the diversity of plant and animal communities and the persistence of native species on NFS lands.

Sections 219.8 and 219.9 are the same as Alternative A. Therefore, under Alternative E, effects would be the same as those described for Alternative A. Plans would incorporate a complementary coarse-filter and fine-filter strategy (§ 219.9) to conserve biological diversity within the plan area; emphasize ecological restoration and connectivity; and incorporate additional species-specific plan components focused on species viability. In terms of species diversity and viability, they would have similar effects to those disclosed under Alternative A. Planning would include specific requirements for collaboration and coordination (§ 219.4) that would be expected to result in greater assurances that responsible officials would gather, assess, and incorporate information from beyond national forest and grassland boundaries into the development or revision of a plan. These procedures and processes specifically emphasize gathering, assessing, and incorporating information beyond national forest and grassland boundaries, which should lead to more effective approaches to the conservation of all species within the region of a plan.

Managing Ecological (Habitat) Conditions

Effects on Plan Content and the Planning Process

Sections 219.8 and 219.9 of Alternative E set forth requirements relevant to managing ecological conditions to maintain the diversity of plant and animal communities and the

persistence of native species on national forests and grasslands. The provisions under these sections in Alternative E are the same as those in Alternative A. Therefore, Alternative E would be expected to have similar effects on plans as those described for Alternative A.

Effects on Resources Expressed as General Outcomes Over Time

Sections 219.8 and 219.9 are the same as Alternative A. Therefore, under Alternative E, effects would be the same as those described for Alternative A.

Monitoring to Assess Effectiveness

Effects on Plan Content and the Planning Process

Section 219.12-Monitoring of Alternative E sets forth requirements relevant to monitoring and assessing the effectiveness of the plan components in achieving the ecological conditions for maintaining the diversity of plant and animal communities and the persistence of native species on national forests and grasslands.

In terms of monitoring species diversity, this alternative specifically requires:

- Increased emphasis on evaluation of ecological conditions, ecological integrity, and sustainability during assessment (§ 219.6).
- An expanded list of required monitoring questions and indicators beyond those required in Alternative A, and required signal points that alert the responsible official of the need to take action (§ 219.12).
- Required monitoring questions and indicators related to:
  - ✓ Key ecological conditions affecting species of conservation concern, with a focus on threats and stressors.
  - ✓ Status of key ecological variables for healthy and resilient aquatic and terrestrial systems.
  - ✓ Status and trends of vegetative diversity.
  - ✓ Status and trends of invasive species and effectiveness of management activities in controlling invasive species.
  - ✓ Status and trends of outbreaks of native insects and pathogens.
  - ✓ Risks and uncertainties associated with climate change.

Effects on Resources Expressed as General Outcomes Over Time

Based on the effects on plan content and the planning process provided above, the information and context specific to this issue provided in the Affected Environment for this section, and the scientific overview provided under the Dynamic Nature of Ecosystems section presented earlier in Chapter 3, the following statements can be made relevant to the effects that this alternative would have on monitoring the diversity of plant and animal communities and the persistence of native species on NFS lands.

Section 219.12 in this alternative sets forth very specific requirements for a highly focused biological monitoring program for monitoring ecological conditions and species populations on national forests and grasslands.

The additional monitoring requirements under this alternative go well beyond the scope, scale, and specificity of the requirements under any of the other alternatives.

- They prescribe very specific monitoring questions pertinent to assessing the effectiveness of the plan in maintaining species diversity and healthy, resilient terrestrial and aquatic ecosystems.
- They require additional species-specific monitoring for terrestrial and aquatic threatened, endangered, and sensitive species.
- They require additional explicit requirements for monitoring key ecosystem characteristics, including connectivity, and invasive species.
- They require added attention to the potential effects of climate change on the plan area.

If the Agency were able to effectively and adequately answer these questions in a timely manner, it could be better equipped to foresee potential detrimental changes to plan area ecosystem characteristics that might have an adverse effect on species diversity and ecosystem integrity. However, the large number of specified monitoring questions under this alternative could reduce a unit's opportunity to address other biological or ecological questions unique to its plan area.

Section 219.4 in this alternative provides a mandatory and more structured process for collaboration during plan development or revision. In terms of implications for species viability, managing ecological conditions, and monitoring, additional public participation requirements on a structured public participation process can result in: more fully incorporating an all-lands approach to maintaining species viability within and beyond the plan area; bringing new and innovative concepts to the issues; and increased ownership in Agency-based approaches to maintaining biological diversity. However, the specified approach required under this alternative may not be the best fit in all situations.

Therefore, under Alternative E, plans would add plan monitoring elements (§ 219.12) that are more likely to assess the overall effectiveness of plan components towards maintaining biological diversity within the plan area in a more accurate and timely manner than under the other alternatives. Reliable information from this monitoring would be expected to identify the need to change either a plan or management activities in a timelier manner than under the other alternatives.

WATERSHED PROTECTION

Affected Environment

Forested watersheds are essential to sustaining the Nation's freshwater supply. More than 50 percent of the freshwater supply in the U.S. originates on forested lands. NFS lands

alone provide 18 percent of the Nation's water and over half the water in the West (Brown et al. 2008).

The USDA Forest Service:

- Manages 193 million acres of national forests and grasslands that contain approximately 400,000 miles of streams, 3 million acres of lakes, and many aquifer systems that serve as the largest source of drinking water in the contiguous United States.
- Administers more than 90,000 water rights in cooperation with states.
- Protects and improves habitat for more than 550 rare, threatened, and endangered aquatic species.
- Provides outdoor recreation to more than 130 million visitors per year near streams, lakes, and other water resources.
- Supports access and operations for more than 200 hydroelectric facilities (Furniss et al. 2010).

During scoping, the public expressed an interest in using watershed protection and water quality as a foundational reflection of landscape health and management. While all of the alternatives analyzed differ in how they approach watershed protection and restoration overall, key differences occur in the requirements for how plans would address management of watershed condition, road systems, and riparian areas—elements that influence water quality. These four aspects were selected as indicators and are evaluated and used to display differences in effects between the alternatives. The following sections provide an overview of policy and law, existing conditions, trends in management, and current plan direction and science related to these indicators.

Watershed Condition

The restoration of watersheds and forest health is a core management objective for national forests and grasslands. The Forest Service is directed to restore degraded watersheds by strategically focusing investments in watershed improvement projects and conservation practices at landscape and watershed scales (USOMB, 2006). In a 2006 review of the Forest Service Watershed Program, the Office of Management and Budget (OMB) concluded that the Agency lacked a nationally consistent approach to prioritizing watersheds for improvement (USOMB 2006). Also, OMB noted a need for improvement in the tracking of watershed condition class and how conditions changed over time.

To address those issues a new national watershed condition framework (WCF) approach was designed and implemented that uses annual outcome-based performance of progress toward improving watershed condition on NFS lands. The WCF proposes to improve the way the Forest Service approaches watershed restoration by targeting the implementation of integrated suites of activities in those watersheds that have been identified as priorities for restoration. The WCF also establishes a nationally consistent reconnaissance-level approach for classifying watershed condition, using a comprehensive set of 12 indicators that are surrogate variables representing the underlying aquatic ecological, hydrological,

and geomorphic functions and processes that affect watershed condition. Primary emphasis is on aquatic and terrestrial processes and conditions that Forest Service management activities can influence. The approach is designed to foster integrated aquatic-, hydrologic-, and geomorphic-based watershed assessments; target programs of work in watersheds that have been identified for restoration; enhance communication and coordination with external agencies and partners; and improve national-scale reporting and monitoring of program accomplishments. The WCF provides the Forest Service with an outcome-based performance measure for documenting improvement to watershed condition at forest, regional, and national scales. The six steps of the WCF are:

Step A: Classify the condition of all 6th-level watersheds in the national forest by using existing data layers, local knowledge, and professional judgment.

Step B: Prioritize watersheds for restoration: establish a small set of selected watersheds for targeted improvement equivalent to a 5-year program of work.

Step C: Develop watershed restoration action plans that identify comprehensive project-level improvement activities.

Step D: Implement integrated suites of projects in priority watersheds.

Step E: Track restoration accomplishments for performance accountability.

Step F: Verify accomplishment of project activities and monitor improvement of watershed and stream conditions.

http://www.fs.fed.us/publications/watershed/Watershed_Condition_Framework.pdf. Watersheds will be reclassified as changes occur within a watershed.

Table 3. Watershed Condition Based on WCF Assessments Results, May, 2011.

Watershed Condition Class	NFS lands only	
	# of watersheds	%
Class 1- Functioning Properly	7,882	52%
Class 2- Functioning at Risk	6,751	45%
Class 3- Impaired Function	431	3%
Total watersheds	**15,064**	100%

Watersheds are neither equally valuable nor equally vulnerable to adverse impacts. Setting management priorities can help ensure that investments provide the greatest possible benefits (Furniss et al. 2010). Planning (at the project or the plan level) can identify areas that warrant special protections or changes in management owing to their importance in storing water and protecting particularly valuable resources (Furniss et al. 2010). Many current Forest Service policies and recommendations center on establishing priority watersheds for focusing management, such as PWJSI (USDA Forest Service

2010h), Aquatic Restoration Strategy (USDA Forest Service 2005a), and the Watershed Condition Framework.

The USDA Strategic Plan FY 2010-2015 (USDA 2010a) identifies key Departmental priorities and desired outcome related to watershed condition; it also includes these goals, objectives and performance measures to achieve them:

- Goal 2—Ensure our National Forests and private working lands are conserved, restored, and made more resilient to climate change, while enhancing our water resources.
    - Objective 2.3—Protect and enhance America's water resources.
        - Performance Measure 2.3.1—Acres of National Forest System watersheds at or near natural condition.
            - Target for 2015 is 62 million acres (32 percent of NFS lands).

Agency-specific direction to implement the USDA Strategic Plan is found in the USDA Forest Service Strategic Plan (USDA Forest Service 2007d), including the following goals, objectives, and performance measures and targets related to watershed protection:

- Goal 1—Restore, sustain, and enhance the Nation's Forests and Grasslands.
    - Objective 1.5—Restore and maintain healthy watersheds and diverse habitats.
        - Performance Measure—Percentage of watersheds in class 1 condition.
            - 2005 Baseline: 30 percent; 2012 Target: 32 percent.
        - Performance Measure—Acreage and mileage of terrestrial and aquatic habitat restored consistent with forest plan direction.
            - 2005 baseline: 642,000 terrestrial acres; 2012 target: Increase by 5 percent annually.
            - 2005 baseline: 4,600 stream miles; 2012 target: Increase by 5 percent annually.
            - 2005 baseline: 18,000 lake acres; 2012 target: Increase by 5 percent annually.

There are a number of additional ongoing efforts by the Forest Service to improve watershed condition. The Priority Watershed and Jobs Stabilization Initiative (PWJSI) is part of the Agency's FY2011 and FY 2012 budget justifications under the Integrated Resource Restoration (IRR) program (USDA Forest Service 2010h). It was one component in the Agency's restructuring of the budget to better align with the increasing focus on watershed and landscape restoration. The primary goals of the PWJSI are to demonstrate the Agency's ability to prioritize watershed restoration needs and to focus the Agency's available resources toward restoring watershed condition in watersheds identified as a high priority for restoration or maintenance.

Executive Order (E.O.) 11990 requires agencies to "minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands." To meet these objectives, the Order requires federal agencies, in planning their actions, to consider alternatives to wetland sites and limit potential damage if an activity affecting a wetland cannot be avoided. E. O. applies under all alternatives.

Wilderness areas are expected to continue to provide stable watershed conditions and high quality aquatic and hydrologic services. Currently on NFS lands there are 439 wilderness areas totaling 36.2 million acres. Over the past 10 years, there was an 8 percent increase in number of wilderness areas (36) and a 2 percent increase in area (927,575 acres) on NFS land. Ecological processes in wilderness areas are driven by natural disturbance regimes, under which ecosystems retain resilience. That is not to say that aquatic resources in wilderness areas are immune to the effects of stressors, particularly airborne stressors such as nitrogen and mercury deposition or that wilderness areas represent a full range of ecosystem or watershed types within NFS lands. Still, under all alternatives, wilderness areas would continue to serve as anchor points for sustained flow of ecosystem services, including clean water and high quality aquatic and terrestrial habitats.

Successful management for resilient watershed conditions depends on implementation of practices that maintain watershed processes and hydrologic function. A healthy, resilient watershed provides a sustained flow of ecosystem services over the long term (e.g., abundant clean water, aquatic habitat, productive soils); and resists and quickly recovers from disturbances such as floods, fire, and insect outbreaks (See previous section of this chapter on Ecological Integrity and Resilience). The key processes and functions related to resilience (a component of watershed integrity) include the capture and storage of rainfall, recharge of groundwater reservoirs, minimization of erosion, protection of soil quality, regulation of streamflow, storage and recycling of nutrients, and provision of habitat for native species. The types of management actions that might be implemented in order to increase watershed integrity would differ dramatically in different landscapes– they would depend on dominant watershed processes, key watershed services, and principal threats to those services (http://www.fs.fed.us/ccrc/topics/water.shtml)

The connected nature of watersheds—and the fact that there are often multiple owners, interests, and values—often requires collaboration for effective watershed management. The scientific literature suggests that the most important components for maintaining watershed condition include restoration of resiliency [a component of watershed integrity], collaboration across ownerships, priority setting, and adaptive planning processes in the face of changing conditions (Furniss et al. 2010).

There are many examples of projects that have employed similar approaches that have yielded beneficial effects to watershed health and the integrity of aquatic systems. From the very large scale watershed restoration projects such as the Chesapeake Bay Program which has led and directed restoration efforts of the Chesapeake Bay since 1983 (http://www.chesapeakebay.net/index.aspx?menuitem=13853) to smaller scale projects such as the collaborative partnership project that has curtailed acid mine drainage at the Lacy Mine on the Hoosier National Forest (http://www.fs.fed.us/r9/ssrs/story?id=4644) to the Pacific Coast Watershed Partnership (PCWP)

(http://www.fs.fed.us/largewatershedprojects/summaries/index.html) working with 23 federal, state, and private partners in the coastal watersheds and estuaries of western Oregon and Washington. In its first year of linking key estuaries, wetlands and uplands to restore the habitat the project, the PCWP project leveraged funds with Ducks Unlimited and other partners at a 10 to 1 ratio ($855,000 to $9,872,000) and restored 6720 acres of key wetlands, estuaries, riparian areas and upland habitats.

There are many studies that cite the importance of a flexible approach to watershed management that allows managers to adapt plans, management activities and build strategies that account for diverse conditions across watersheds and regions. For example Everest and Reeves (2007) state that: "Strategies that account for the dynamic nature of natural watershed processes … and natural variations in the structure and function of riparian ecosystems by ecoregion and geomorphic province could maintain and restore the function of riparian ecosystems." Jackson et al. (2001) provide an overview of benefits and stressors to global freshwater systems. They state that: "a global perspective on water withdrawal is important for ensuring sustainable water use, but is insufficient for regional and local sustainability. How freshwater is managed in particular basins and individual watersheds is key to sustainable water management."

A review of recently revised plans demonstrates that the guidance included for watershed condition varies widely. Some plans set aside watersheds for conservation or restoration, some refer to managing for enhanced riparian and watershed functions, and some refer to managing for desired watershed conditions. Other plans employ the watershed condition classification approach (Potyondy and Geier 2011) and refer to increasing the proportion of watersheds in good condition based on the WCF and new Forest Service performance metrics. Still other plans focus on meeting water quality requirements for currently 303(d) listed water bodies or focus on mitigating management activities to limit their effects on watersheds.

The general trend in Forest Service management is toward an emphasis on watershed protection, maintenance and restoration. This trend is expected to continue, and to shape land management plans, projects, and activities on NFS lands. Under all alternatives the restoration of watersheds will continue as a core management objective of National Forests and Grasslands. The Forest Service is expected to continue to prioritize watersheds for restoration and to track watershed condition.

Road System

The construction, and even the existence, of forest roads has been a main point of contention between forest managers and some people concerned about the environment. A main criticism is that forest roads affect the environment by increasing soil erosion and sedimentation yield to waterways (e.g., Gumus et al. 2008).

According to the Forest Service Performance Accountability database, there were 375,205 miles of road on NFS land in 2009. The Agency's travel management rule at 36 CFR Part 212, adopted in 2005, has provided a focus for reducing impacts of NFS roads. The number of miles of roads decommissioned and bridges constructed or reconstructed have increased and the miles of road constructed have decreased between 2007 and 2010

(Table 4). Under current funding levels, approximately 1/2 of 1 percent of the total NFS road system is decommissioned annually.

Table 4. Trends on NFS Lands

Year	Bridges Constructed or Reconstructed (#)[a]	Miles of Road Decommissioned	Miles of Road Constructed	Stream Crossings Constructed or Reconstructed for Aquatic Organism Passage.[a]
2007	84	782[b]	100[b]	263
2008	92	1352[c]	95[c]	340
2009	107	1778[d]	67[d]	271
2010	259	2515[a]	-	593

[a] *Data from PAS database.*
[b] *Data from National Forest System Statistics 2007.*
[c] *Data from Forest Service Engineering Budget records.*
[d] *Data from National Forest System Statistics 2009.*

The consideration of the effects of each alternative in this EIS must include the application of the Forest Service travel management rule, at 36 CFR part 212, the NFMA requirements regarding the National Forest Transportation System at 16 U.S.C. 1608, and Executive Order.

Among the purposes of the travel management rule is to identify the minimum necessary road system with an emphasis on reducing roads that have the greatest impact on the environment. The rule specifies that the responsible official must identify the minimum road system needed, and in making that determination the official must incorporate a science-based roads analysis at the appropriate scale. Specific details are found at 36 CFR 212.5(b)(1) (Identification of road system); and 36 CFR 212.5(b)(2) (Identification of unneeded roads)(http://www.gpoaccess.gov/cfr/index.html). To the degree practicable, the responsible official must involve the public, other agencies, and Tribes. Responsible officials are asked to give priority to decommissioning unneeded roads that pose the greatest risk of environmental degradation.

Subpart A of the travel management rule requires each unit of the National Forest System (NFS) to:

- Identify the minimum road system needed for safe and efficient travel and for the protection, management, and use of NFS lands; and
- Identify roads that are no longer needed to meet forest resource management objectives and; therefore, scheduled for decommissioning or considered for other uses. Identifying the minimum road system and unneeded roads requires a travel analysis process (TAP). All NFS units are scheduled to complete a travel analysis process (TAP) report by the end of 2015. Specific detailed direction for the TAP

> can be found in FSH 7709.55, chapter 20, FSM 7712.
> http://www.fs.fed.us/recreation

Results from the TAP must be documented in a travel analysis report, which will include:

- Information about the analysis and recommendations;
- A map displaying the recommended minimum road system;
- A list of recommended unneeded roads; and
- Other reporting requirements.

Travel analysis identifies opportunities and recommendations that can provide information for future management of the national forest road system and will occur regardless of the alternative selected.

Section 10 of NFMA specifically addresses resource concerns with respect to roads by requiring temporary roads to be designed with a goal of reestablishing vegetative cover within a ten year time period, and also by requiring road design standards for impacts on land and resources. In addition, 16 U.S.C. 1608 requires that:

> (b) Unless the necessity for a permanent road is set forth in the forest development road system plan, any road construction on land of the National Forest System in connection with a timber contract or other permit or lease shall be designed with the goal of reestablishing vegetative cover on the roadway and areas where vegetative cover has been disturbed by the construction of the road, within ten years after the termination of the contract, permit, or lease either through artificial or natural means. Such action shall be taken unless it is later determined that the road is needed for use as a part of the National Forest Transportation System.
>
> (c) Roads constructed on National Forest System lands shall be designed to standards appropriate for the intended uses, considering safety, cost of transportation, and impacts on land and resources.
>
> 16 U.S.C. 1608 (b) and (c).

Executive Order 11988, Floodplain Management, was issued in order to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. In furtherance of this objective, the EO directs that:

> each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by flood plains in carrying out its responsibilities for (1) acquiring, managing, and disposing of federal lands and facilities; (2) providing federally-undertaken, financed, or assisted construction and improvements; and (3) conducting federal activities and programs

> affecting land use, including but not limited to water and related land resources planning, regulation, and licensing activities.
>
> EO 11988, Section 1 (42 FR 26951) (May 25, 1977)

To a great extent, the impact of roads is a function of their design and location. Poorly designed or maintained roads and channel disturbance in hilly or mountainous sites have the greatest impact on stream sedimentation, and practices that reduce these impacts can reduce overall changes in sedimentation. Roads might not be an important source of sediment for flat sites (Jackson et al. 2004).

A number of road construction and maintenance practices that minimize erosion and sedimentation have been developed, and a great deal of research has been conducted to identify how to reduce sedimentation from forest access roads (Gucinski et al. 2001). For the past half century, research on road erosion, sedimentation, and better road engineering methods helped to reduce the impact of forest roads by reducing runoff and erosion from the roads. Some of these methods were adopted as standards for forest road construction in the regions for which they were developed (Jackson et al. 2004).

Many human activities in watersheds, including road building and use, accelerate soil erosion and sedimentation in receiving waters by exposing mineral soil to erosive forces (Everest and Reeves 2007). Unpaved roads in forests can affect the movement of water and are a major source of sediment in forests (Elliot 2010). Natural erosion rates in forests tend to be very low, but roadbeds, side-casts, and especially the road bank can be major sources of sediment that enter streams (Joran and Martinez-Zavala 2008).

Roads and roadside ditches can change the natural flow of water in forests both above and below the surface. Compacted surfaces in road beds can generate overland flow, and road beds can intercept subsurface flows at road cuts and alter hill slope hydrologic processes. Roads can redistribute water coming from hill slopes and can change the timing of stream flow, subsurface flow, and the distribution of soil moisture.

Forest road on steep slopes may intercept flow and hasten its arrival as surface flow in stream channels, possibly contributing to increases in peak discharges (Jones and Grant, 1996).

While there has been much study of the effects of roads on aquatic systems and aquatic species, there is uncertainty in the literature regarding a direct cause-and-effect relationship of road *density* to erosion. Gusinski et al. (2001) noted that confounding variables are difficult to separate from road-related ones and that geographic patterns of roads in forest landscapes differ substantially from place to place, with commensurate differences in environmental effects. Cou et al. (2006) examines several studies related to changes in peak stream flow due to road density: “Keppeler and Ziemer (1990) showed annual flow increases correlated with the density of roads, landings, and skid trails, which they attributed to reduced interception evaporation. Most studies, however, have found that the presence of roads does not significantly affect annual stream discharge volume (Rothacher 1970; Harr et al. 1975; King and Tennyson 1984; Wright et al. 1990). However, many watershed studies (Harr et al. 1975; Jones and Grant 1996; Jones 2000)

have found that roads result in higher peak flows and in some basins, observed effects on peak flows were small or undetectable (Ziemer 1981; Wright et al. 1990; King and Tennyson 1984). In several paired-catchment studies (Wright et al. 1990; Jones and Grant 1996; Thomas and Megahan 1998; Beschta et al. 2000) road effects on peak flows were important only for small events. Whereas, Jones (2000) found that road-related peak flow increases were greater for small events in two of four watershed pairs and greater for large events in the other two pair and: "Detecting the effects of roads in these watershed studies was often difficult because the addition of roads was accompanied by other land cover changes, especially forest clearing." Jones (2000) states that streamflow is inherently variable and that disentangling the complex natural effects from human-induced effects represents a challenge. Other studies have found correlation between road density and effects on aquatic resources, for example, Eaglin and Hubert (1993) found that trout standing stocks decreased as the density of road culverts (a measure of the extent to which roads crossed watercourses) increased.

Road density in and of itself is not always an adequate proxy for impact on aquatic resources (Verry and Dolloff 2000) and when road density is associated with impacts to aquatic resources, it tends to be the result of road density being used as an easily quantifiable indicator of land use intensity (Lee et al.1998, Ripley et al. 2005).

Gucinski et al. (2001) noted that the magnitude of road-related geomorphic effects differs with climate, geology, road age, construction practices, and storm history; and these configurations, combined with local geology and climate, result in very different effects of roads on watersheds. Even decommissioning a road can have different effects in different locations.

Regardless of the divergence of opinions regarding which factors related to forest roads (road density, design and placement, mere presence) has the greatest or most measureable effect on aquatic health, there are many benefits to aquatic systems from road deactivation, including improved hydrologic processes, fish passage, headwater aquatic habitat, and water quality (Allison et al. 2004).

Of recent plans reviewed, all provide more protection from road impacts than are required under the existing planning rule (Alternative B). Some plans include Travel Management Rule text in the plan requirements, and other plans refer to the requirements in the Travel Management Rule provisions. Some recent plans call for a limit to the number of stream crossings that are allowed. Other plans are highly prescriptive and include standards for mitigating effects of roads on other resources. Still other plans prioritize roads for decommissioning that are in streamside management areas.

Under all alternatives, the trends for decommissioning more roads, constructing fewer roads and improving aquatic organism passage are expected to continue. The effects of roads on watershed condition are highly variable and depend on many aspects including topography, surface material, condition and maintenance, proximity to water resources and position within the watershed. A poorly sited and maintained road could have a far greater impact on watershed health than several miles of well-sited and maintained roads. However, given the documented effects of roads on various aspects of watershed condition (sedimentation, changes in overland flow), a reasonable assumption is that, in

general, fewer and better maintained roads result in a lower potential for sedimentation to streams, blockage of aquatic passage, habitat fragmentation, channel instability, and alteration of surface and subsurface flows.

Riparian Area Management

The understanding of and policy regarding riparian management have evolved over the last three decades to provide incrementally more protection. The focus changed from single functions at site scales (1970s) to multiple functions on site scales (1980s), to multiple functions at watershed scales (1990s) (Everest and Reeves 2007).

Social pressure to protect environmental assets, including riparian habitats and integrity of aquatic ecosystems, has contributed to the evolution of forest practices (Whitelaw 1992). Beginning in the 1970s, the Forest Service initiated regulations for the protection of riparian and aquatic systems. The original goal was to improve water quality and aquatic habitat. When the 1982 planning rule was adopted, the term "riparian" had for more than 100 years been closely associated with water law (National Research Council 2002) and not with ecological processes.

Currently the National Research Council (2002) considers riparian restoration one of the most critical environmental challenges of our time and a national priority. In the Forest Service today there is a focus on restoring resilience for sustainable hydrologic function (Furniss et al. 2010). Riparian area management continues to be a key strategy for protecting supplies of clean water and for improving the quality of water for ecosystem health and human use. Many states have best management practices (BMPs) for managing riparian areas, and NFS units often use these guidelines as minimum standards. Recently, riparian area management has become even more important as an alternative to preparing total maximum daily load (TMDL) assessments for compliance with the Clean Water Act (Sims and Knopp 2007).

Since 2002, the Forest Service has increased emphasis on and funding for stream and riparian area enhancement and restoration. Table 5 shows the number of miles of stream and riparian habitat restored or enhanced between 2002 and 2010.

Table 5. Trends for Stream and Riparian Area Restoration or Enhancement

Year	Miles of Stream Habitat Restored/ Enhanced
2002	1,375
2003	1,788
2004	1,623
2005	1,799
2006	1,300
2007	1,918
2008	2,361
2009	3,498
2010	3,347

Data from 2006 OMB assessment for 2003-2007, from PAS database 2008 and 2010.

Riparian areas are important components of watersheds that provide critical transition zones linking terrestrial and aquatic ecosystems, and exert important controls over the characteristics of streams and rivers. The influence of riparian areas on the quality of water and aquatic ecosystem functions is well-documented, as is the case for restoring and managing riparian areas (Dosskey et al. 2010). Healthy, functioning riparian areas provide many benefits including clean water, stream channel stability, groundwater recharge, flood control, maintenance of streamflows, production of high-value aquatic resources, timber production, maintenance of biodiversity in the aquatic and terrestrial interface, focal sites for outdoor recreation, property value, visual aesthetics, livestock production from riparian forage, and mining for gold and other minerals (Furniss et al. 2007). Riparian areas contribute to the physical structure of aquatic habitats (Reeves et al. 1993), water quality and the natural temporal and spatial regimes of streamflow (U.S. Army Corps of Engineers 1991), nutrient supply (Clinton et al. 2002), and energy supply (Everest and Reeves 2007). Naiman et al. (2005) state that it is nearly impossible to place monetary values on goods and services provided by [riparian areas], whether for nature or for human societies. Nevertheless, enough is known about [riparian areas] to appreciate their value in providing clean water, flood control, habitat for plants and animals, and countless other values that sustain human well -being.

Human disturbance regimes have directly or indirectly changed characteristics of aquatic and riparian habitats over the past 150 years, in ways that are quite different from changes due to natural disturbance. Traditionally management of forested land has emphasized economic values at the expense of ecological and social values (Everest and Reeves 2007). Until recently, a goal of forest management [on both public and private lands] has been to find the minimum level of protection needed to maintain productive riparian and aquatic habitats (Everest and Reeves 2007). Often best management

practices (BMPs)s were compromises between social, political, and ecological goals for riparian management, and the best scientific information was seldom used in making management decisions. As a result, between 1970 and 1990, even while BMPs were in effect, the quality of riparian and aquatic habitat on forested land declined (USDA and USDI 1996). An estimated 70 percent of natural riparian communities have been lost as a result of human activities across ownerships in the Pacific Northwest (Malanson 1993). On NFS lands, estimates indicate that riparian conditions are good in more than 90 percent of Alaska, 70 percent of the East, and 60 percent of the South; in the West good riparian areas range from more than 50 percent in more humid areas to less than 30 percent in semiarid and arid areas (Sedell et al. 2000) Reasons for poor riparian condition vary significantly across the country. Past timber harvest, roading, recreation, and urban encroachment account for much of the problem in the East, South, Alaska, and humid portions of the West. Livestock grazing, roading, recreation, mining, and urban encroachment account for much of the problem in drier parts of the West (Sedell et al. 2000)

Naiman et al. (2005) describe four ultimate drivers that have and are affecting all ecological systems including riparian ecosystems: human demography, resource use, technology development and social organization which can collectively result in changes to the system such as physical restructuring of river and riparian systems, introduction of exotic species, discharge of toxic substances or over harvesting of resources. Ecological systems generally lack the capacity to completely adapt to these stresses which can result in degradation.

Timber harvest and road development have changed riparian vegetation and watershed hydrologic regimes and aquatic communities (Jones et al. 2000, Trombulak and Frissell 2000). Some of these changes have contributed to the Endangered Species Act listing of aquatic organisms including salmonid populations (Everest and Reeves 2007).

Roads parallel streams in many forested river valleys on public and private lands, encroaching on stream channels and occupying portions of former sites of riparian forests. Encroachment and loss of riparian vegetation in areas occupied by roads causes persistent changes in the character and function of riparian areas and corresponding changes in the productivity of associated aquatic habitats (Everest and Reeves 2007), and can contribute to temperature changes in streams.

On the other hand, strictly buffering riparian areas from all management activity might not always lead to healthy, functioning riparian areas. While restricting vegetation treatments such as timber cutting and prescribed burning in riparian areas and adjacent buffers protects these areas in the short run, ecologists are beginning to question the wisdom of this policy over the longer term. Studies of disturbance history of forested riparian areas are providing evidence that fires visited riparian zones adjacent to upland, fire-adapted ecosystems. These fires rejuvenated riparian areas by reducing less diverse coniferous vegetation and promoting more ecologically diverse deciduous vegetation, such as willows and cottonwood, although areas of higher soil moisture [associated with riparian areas] may have served as areas of disturbance refugia (Camp et al. 1997). Periodic fire or disturbances that mimic fire might be needed to maintain the vitality and resiliency of riparian habitats in the long run (Everest and Reeves 2007). Some riparian

ecosystems evolved on landscapes where fire was frequent (Arno 1996, Everett et al. 2003), and fire suppression might have degraded the structure and functional capacity of riparian areas compared to what would exist under natural conditions (Dwire et al. 2010). Also see previous discussion on Dynamic Nature of Ecosystems.

Explicit guidelines for riparian management have only emerged in recent decades. Federal land managers began to use buffer strips and riparian protection measures in the late 1960s following passage of the Multiple-Use Sustained-Yield Act of 1960. Few specific guidelines governed the management of federal riparian areas, however, until the National Forest Management Act and the Federal Land Policy and Management Act of the mid-1970s (Gregory 1997).

Under the 1982 rule provisions the responsible official is to give "special attention" to riparian areas that are approximately 100 feet from the edges of bodies of water, and within these areas prohibit management practices that can seriously and adversely affect water conditions or fish habitat.

The current scientific literature on width of riparian management zones necessary for effective protection largely argues for an adaptable approach tailored to regional or watershed characteristics or the values being protected. Ellis (2008) in a three part series entitled "The Need for Stream Vegetated Buffers: What Does the Science Say?" summarizes the scientific recommendations underlying the vegetated buffer sizes needed to protect water quality, fish and aquatic habitats and wildlife and wildlife habitat. In part one of this series Ellis found that based on a review of 77 scientific studies conducted on the size of streamside vegetated buffers to protect water quality, estimates necessary to filter pollutants vary greatly depending on soil type, slope, vegetation type and density, climate, floodplains and many more factors and range from 4 meters (13 ft.) to 262 meters (860 ft.). In part two of this series Ellis found that based on a review of 34 scientific studies conducted on the size of streamside vegetated buffers to protect fish and aquatic habitat, estimates ranged from 10 meters (33 ft.) to 130 meters (427 ft.) depending on the values you are trying to protect and the site conditions. In part three Ellis found that based on a review of 83 scientific studies conducted on the size of streamside vegetated buffers to protect wildlife and wildlife habitat ranged from 9 meters (30 ft.) to 1,600 meters (5,250 ft.) again depending on the values you are trying to protect and the site conditions.

Gregory (1997) states that an innovative and ecologically sound feature of the riparian reserves established as a result of FEMAT(1993) was a scaling criterion developed for delineating [riparian management zone] boundaries: "Instead of lapsing into the traditional debate over the width of the riparian management zone, boundaries were based on site potential trees. A site potential tree is the average height of trees that have attained the maximum height possible given the site conditions. Unlike previous definitions of riparian management zone boundaries, this definition is transferable to other forest types and locations and is linked to ecological conditions." Naiman et al. (2005) states that riparian management is highly site specific. "There are important community variables in time and space, strong legacies of ancient practices, and connections between social and environmental components at multiple scales. The

properties specify what can be an adaptive, a sustainable, and a locally appropriate management approach [to riparian management]."

Everest and Reeves (2007), when discussing riparian conditions in the Pacific Northwest, state that forest practice rules applied from the 1970s to the early 1990s failed to achieve their goal of riparian management because they focused largely on defining minimum buffer widths for riparian protection at site scales. Focus at the landscape scale, however will require that appropriate goals and objectives be established for the landscape. These authors further state that: "Strategies that account for the dynamic nature of natural watershed processes, the natural spatial and temporal fluctuations in the quality of riparian and natural variations in the structure and function of riparian ecosystems by ecoregion and geomorphic province could maintain and restore the structure and function of riparian ecosystems."

Everest and Reeves (2007) state that when defined physically, riparian ecosystems generally have a linear structure that may be hundreds of kilometers in length and highly variable in width. The floodplains of large rivers may contain extensive riparian habitats with widths of a kilometer or more. Conversely, riparian zones along small, incised headwater streams may be only a few meters wide. The width of riparian habitat for a given stream size varies by climatic zone in the Northwest, with the greatest widths in the humid regions west of the Cascade Mountains and at higher elevations across the region, and progressively narrower widths in drier areas. Riparian zones in the temperate rain forests of southeast Alaska, because of high annual precipitation that creates expansive upslope fens, bogs, and forested wetlands, may extend considerable distances upslope from streams. Everest and Reeves (2007) note that attempting to apply rigid management prescriptions at the watershed scale to variable conditions might not achieve desired riparian management goals. Expanding on this assumption, rigid management prescriptions at the national scale might not provide the flexibility necessary to effectively protect riparian function across highly variable systems.

Plans recently revised under the 1982 rule procedures vary in the guidance they provide for riparian area management. In some plans this area is a protective strip of predominantly undisturbed soil, but logging and heavy construction equipment are sometimes allowed to operate in the protective strip when soils are dry, frozen, or covered with sufficient snow to minimize soil disturbance. Other plans use a 100-foot buffer as a minimum standard for protection and/or provide for a wider habitat zone. One plan specifies that when management activities occur in the riparian corridor special attention is given to soils, hydrology, and riparian dependent resources and no trees should be removed from within 10 feet of the stream channel banks except for road construction or maintenance. Still other plans use standards based on the state BMPs. Some plans focus on maintaining desired stream function and preventing the degradation of aquatic conditions, but allow limited short-term negative effects if the long-term benefits to the riparian conservation area are outweighed by limited short-term effects. Other plans refer to regional direction for riparian area management and condition classes.

The general trend in Forest Service management is toward an emphasis on watershed protection, maintenance, and restoration. This is expected to continue to shape land

management plans, projects, and activities on NFS lands and to influence how riparian areas on NFS lands are protected or managed. Under all alternatives, the restoration of watersheds and forest health as a core management objective of national forests and grasslands is expected to continue. The trends toward improving stream crossings and decommissioning roads with the highest resource impacts are also expected to continue and will have positive effects on riparian area function.

Water Quality

In 1891, public concern about adequate supplies of clean water led to the establishment of federally protected forests in the United States. Under the Organic Administration Act of 1897, one of the purposes for which national forests are established is "for the purpose of securing favorable conditions of water flows" (16 U.S.C. 475). The Multiple-Use Sustained Yield Act further provides that watershed purposes are among the purposes for which the national forests are established and administered (16 U.S.C. 528). Much of the Nation's freshwater originates on forests, and the value of water coming from National Forest System lands was estimated to be $3.8 billion per year in 2000 (Sedell et al. 2000).

Although forested land provides the highest quality water of all land uses, and forests are effective at maintaining hydrologic functions, there are areas on the national forests and grasslands where water resources are degraded (65 *Federal Register* 62566, October 18, 2000). In 2006, the U.S. EPA reported 2,624 impaired water bodies on NFS land, with 18,363 segments that contain at least 50 percent NFS lands (USOMB 2006). These waters are priorities for restoration because they do not attain State water quality standards. Most impaired water segments have been listed because of elevated temperatures, excess sediment, and habitat modification (Grumbles and Kimbell 2007). There is a higher probability of streams on NFS lands being listed than water on other lands, not because water quality on NFS lands tends to be of poorer quality but because a high percentage of small streams on NFS lands are monitored (Sims and Knopp 2007). Sims and Knopp (2007) also note that the listing process in combination with ambiguous state standards for sediment and temperature have resulted in some questionable listings. Not all impaired segments on the National Forests can be resolved unilaterally by the Agency, and many require collaborative actions among many private and governmental agencies (USOMB 2006).

The Forest Service has developed a National Best Management Practices (BMP) Program to help ensure implementation of appropriate BMPs for ground-disturbing activities on National Forest System lands. Under this program, The National BMP Program will apply across all NFS lands and address commitments for both internal and external accountability. The Program consists of 3 main components:

1. the National Core BMP Technical Guide (Volume 1);
2. the National BMP Monitoring Technical Guide (Volume 2); and
3. revised national direction.

The Clean Water Act (CWA), implementing regulations and FS policy require the Agency "to establish and administer a program…of installing and maintaining measures

incorporating best management practices to control nonpoint source pollution for improved water quality." Each Forest Service region has adopted a BMP strategy, although the programs differ somewhat. Most have a regional handbook listing State certified BMPs or Forest Service-approved soil and water conservation practices. National Core BMPs will establish a framework for the implementation and monitoring of applicable regional and state BMPs. The National Core BMPs are anticipated to be finalized by the end of CY2011; the National BMP Monitoring Protocols are anticipated to be finalized by the end of CY2012. The revised national direction is scheduled to be completed in draft by the end of CY2012 and will be subject to public comment. This direction will apply under all alternatives.

The major impacts on water quality on NFS lands are from non-point sources and roads. The effects displayed under watershed protection and the road system serves as corollaries for effects on water quality. Alternatives that require higher levels of watershed protection and emphasize restoration and maintenance of watershed condition would provide greater potential for restoring or protecting water quality. All alternatives require compliance with the Clean Water Act, the Safe Drinking Water Act and must address listed water segments through either TMDL or BMP approaches.

Recently revised plans vary in the guidance they include for water quality. They range from making reference to regional soil and water practices and design criteria and minimal additional standards and guidelines to detailed standards and guidelines and management direction for watersheds containing impaired water bodies, to compliance with TMDLs in addition to having more specific standards and guidelines for protecting water quality. Some plans specify criteria for managing for municipal water use and restoring watersheds to meet the goals of the Clean Water Act and Safe Drinking Water Act, and some specify the need to maintain canopy cover to maintain appropriate water temperatures.

Some recently revised plans specify that State forestry BMPs should be implemented as plan guidelines and other plans specify that the state water quality standards should be used for protection of drinking water quality where appropriate. Other plans have water quality standards that are quite general.

Most of these plans require monitoring to assess how well the soil and water conservation practices protect water quality or specify that condition on watersheds would be evaluated at varying intervals.

Alternative A (Proposed Action) Effects

Watershed Condition

Effects on plan content and the planning process

Alternative A includes requirements for public engagement, a framework for adaptive management, assessment of stressors that could affect watershed health, an all-lands approach, identification of priority watersheds for maintenance and restoration, plan components to maintain or restore the structure, composition, function, and connectivity of aquatic and terrestrial ecosystems and watersheds and monitoring of watershed

conditions using a two tiered monitoring approach. This alternative provides a planning framework for addressing watershed health but allows for flexibility to accommodate new information as it becomes available, addressing different resource conditions across a highly variable system and for guiding the responsible official in using the best available scientific information to inform planning decisions.

Specifically this alternative requires:

- an emphasis on collaboration and working with partners across the landscape in all phases of the planning cycle. Additional requirements for outreach to traditionally underserved communities (§ 219.4) could result in plans that reflect a broader spectrum of public values concerning watershed condition, riparian areas, and water quality.
- use of a planning framework that includes assessment, planning, and monitoring, in a continuous learning cycle (§ 219.5).
- assessment of (§§ 219.6 and 219.8) terrestrial and aquatic ecosystems, air quality, disturbance regimes, fire risk, wildland fire, and potential system drivers including climate change, and other information to understand and assess existing and potential future conditions and stressors in order to inform and develop plan components for sustainability.
- use of an all-lands approach by requiring assessments to consider and evaluate existing conditions, trends, and potential future conditions across the broader landscape (§ 219.6) and plan content to describe the unit's distinctive roles and contributions within the broader landscape(§ 219.7).
- identification of watershed(s) that are a priority for maintenance or restoration (§ 219.7).
- plan components to maintain or restore structure, function, composition, and connectivity of healthy and resilient terrestrial and aquatic ecosystems and watersheds (§ 219.8).
- development of plan components with consideration of the contributions of the unit to ecological conditions within the broader landscape influenced by the plan area; and conditions in the broader landscape that may influence the sustainability of resources and ecosystems within the plan area; potential system drivers, stressors, and disturbance regimes, including climate change; and the ability of those systems on the unit to adapt to change (§ 219.8).
- a two-tiered monitoring approach consisting of a unit monitoring program and a broader scale monitoring strategy to address monitoring questions that can best be answered at a scale broader than the unit. The unit monitoring program would be part of required plan content developed during development of a new plan or plan revision, with input provided by the public. Section 219.12 requires the monitoring program to include at least one monitoring question for each of eight specific monitoring topics. This requirement is designed to link the monitoring program back to the assessment and plan development or revision phases of the planning framework and to the plan content requirements set forth in other sections of the proposed rule, thereby creating a feedback loop for adaptive management. The broader scale monitoring strategy should serve the same purpose, but provide information from a broader scale.

This alternative does not specifically require watershed scale assessments, but it does require the assessments and monitoring needed to develop plan components to maintain or restore watersheds (§§ 219.7 through 219.10). Also see previous discussion on Inherent Capability of the Land and multi-scale hierarchical approaches for understanding ecosystems. Rather than define the scale of assessments, this alternative would allow the flexibility to determine the most appropriate unit (ecological or geographical) to use for developing plans, gather information, or monitor as long as the responsible official is able to demonstrate the best available scientific information has been used to inform that decision (§ 219.3 and preamble to the proposed rule).

Effects to resources expressed as general outcomes over time

Alternative A requires that plans maintain, protect and restore watershed health and riparian areas, use a collaborative approach to planning, consider stressors on and off NFS lands, use a landscape level approach that considers plans and objectives of other landowners within the landscape.

Collaborative approaches to restoration at the landscape level are expected to continue under all alternatives; however, under Alternative A (as well as Alternatives D and E) this approach will be consistently incorporated into land management plans and implementation of these plans is expected to yield positive benefits for watersheds.

Alternative A requires the identification of watersheds that are a priority for maintenance and restoration. All alternatives are expected to be consistent with the current policy to identify priority watersheds.

Alternative A's requirements regarding monitoring for ecological and watershed conditions is intended to support achievement of the sustainability and diversity requirements of §§ 219.8 and 219.9 and the provisions of multiple uses and ecosystem services in § 219.10. The two-tiered monitoring approach required by this alternative is designed to increase the effectiveness and efficiency of Forest Service monitoring programs. Alternative A is expected to enhance the effectiveness of observation networks and current monitoring networks and so would provide information for the early detection of and ecological change associated with climate change (Joyce et al. 2009).

Based upon Alternative A’s effects on plan content and the planning process, the information provided above, and the information issue provided in the Affected Environment - Watershed Condition, the following statements can be made relevant to the effects that this alternative, if implemented, would have on watershed conditions.

As plans created or revised to meet the requirements of Alternative A are implemented, watershed conditions are expected to improve with the maintenance or restoration of watershed *composition* (distribution and extent of major vegetation types; presence and distribution of invasive species; and types of wetlands, lakes, streams, and ponds); *structure* (vertical and horizontal distribution and pattern of vegetation, downed woody debris distribution, connectivity among habitats' stream habitat complexity, and riparian habitat structure); and *function* (types, frequencies, severities, and spatial patterns of disturbances such as fires, landslides, and floods; stream and lake temperature and

nutrient regimes; riverine flow regimes; nutrient cycling; and soil productivity) and connectivity. (See previous discussion on Dynamic Nature of Ecosystems as well the Ecosystem Restoration section of this draft PEIS). Restoration activities may produce short term negative impacts in order to provide for long term benefits, but these impacts can only be assessed at the site specific level and will vary depending on type of restoration treatment, current condition of the resource and characteristics of the area being restored. The identification of priority watersheds should help to focus efforts beyond the site level to the watershed level so that whole watersheds can move toward improved condition. The degree to which systems can reach a range of desired behaviors will depend on many factors – cause and degree of degradation, irreversibility of past actions or changes, viability of remaining populations, financial resources, and the timeframe for desired recovery (Gregory 1997).

Road System

Effects on plan content and the planning process

Alternative A does not include specific requirements related to managing the road system. However, it is reasonable to expect that the requirements for assessment, development, and monitoring of plan components to address watershed composition, structure, and function and connectivity—as well as specific elements of watershed health (such as lakes, streams, and riparian areas) (§ 219.8)—would yield plans that include desired conditions, objectives, standards, or guidelines for addressing the impacts of roads on watersheds, where impacts exist. This alternative does not include a requirement that plans include standards for road density. It allows for flexibility in determining which stressors have the potential to negatively affect watershed condition and for developing plan components to address those stressors while meeting the requirements for maintenance and restoration of watershed composition, structure, and function (§ 219.8).

Under this alternative, the effects of roads on watershed health and aquatic resources would be considered and, where appropriate, plan components for protecting, restoring, and maintaining watershed condition related to the road system would be developed (§ 219.8). In some cases, this could include road density standards. In other cases, plan guidance related to roads might focus on reducing the impacts of roads on watershed health rather than on reducing the density of roads within the watershed.

Effects to resources expressed as general outcomes over time

Based upon the effects on plan content and the planning process the information provided above and the information issue provided in the Affected Environment - Road System, the following statements can be made relevant to the effects that this alternative, if implemented, would have on watershed conditions.

This alternative allows for a flexible approach for addressing the impacts of road management, recognizing the variability of conditions and effects of roads on water resources across NFS lands. For example, many of the roads on eastern forests with mixed ownerships are a mixture of Forest Service, local government, county, and State

roads, and federal highways. In watersheds where the percentage of NFS land or road ownership is low, setting maximum road density standards for NFS roads would be an ineffective tool for maintaining and restoring watershed condition.

With The watershed maintenance and restoration emphasis of Alternative A, coupled with the travel management rule and ongoing Agency and USDA policy for watershed protection and restoration, the trend of a reduced road system would be expected to continue. Prioritization of where to decommission roads under this alternative could be based on impacts to watersheds, habitat or other resources, road density standards, or other factors. There are many variables that will affect the rate of road decommissioning, the specific roads that will be decommissioned and the resulting effects of those activities including funding levels, the number and location of existing roads on any given unit, the need for access to meet multiple use needs, and the existing condition of roads or the watersheds they are in. A road system that is properly maintained should result in less impacts (sedimentation, aquatic organism passage, disruption of overland flows, etc.) of roads on aquatic and riparian resources than is being experienced today.

Riparian Area Management

Effects on plan content and the planning process

Under Alternative A all plans will:

- include plan components to maintain or restore the structure, function, composition, and connectivity of healthy and resilient terrestrial and aquatic ecosystems and watersheds in the plan area (§ 219.8);
- include plan components to maintain, protect, or restore riparian areas (§ 219.8);
- establish a default width for riparian areas around all lakes, perennial or intermittent streams, and open water wetlands, within which these plan components will apply. The default may be a standard width for these water bodies, or may vary based on ecologic or geomorphic factors, or the type of waterbody, and will apply unless the riparian area has been site-specifically delineated (§ 219.8); and
- include components to maintain or restore the structure, function, composition, and connectivity of healthy and resilient terrestrial and aquatic ecosystems and watersheds in the plan area (§ 219.9).

These requirements exceed the requirements that are required by Alternative B (No Action); however, as noted under the Affected Environment section, recently revised plans often exceed the riparian requirements of Alternative B.

Effects to resources expressed as general outcomes over time

As plans created or revised to meet the requirements of Alternative A are implemented, riparian areas across the system are expected to be maintained where they are in good condition and restored where they have been degraded. Restoration activities may produce short term negative impacts in order to provide for long term benefits, but these impacts can only be assessed at the site specific level and will vary depending on type of

restoration treatment, current condition of the resource and characteristics of the area being restored.

The importance of restoring and maintaining riparian function in order to maintain water quality and riparian and aquatic habitat is well-documented in science. There is little divergence of opinion on this topic in the scientific literature.

Water Quality

Riparian area values such as temperature regulation, large woody debris recruitment, bank stabilization, and others would be expected to improve. The degree to which systems can be restored will depend on many factors – cause and degree of past actions or changes, financial resources and time frame for desired recovery.

Effects on plan content and the planning process

See effects under Watershed Protection, Riparian Areas, and Road System. In addition, under this alternative, plans would:

- take into account the impacts and potential stressors and how they could affect water quality, quantity, and availability
- comply with requirements of the Clean Water Act, the Safe Drinking Water Act, and all substantive and procedural requirements of Federal, State, and local governmental bodies with respect to the provision of public water systems and the disposal of waste water.
- include components to prevent or mitigate detrimental changes in water quantity, quality, and availability, including temperature changes, blockages of water courses, and deposits of sediments and plan components to maintain and restore water resources on the unit, such as lakes, streams, and wetlands; ground water; public water supplies; sole source aquifers; source water protection areas; and other sources of drinking water.
- include a two tiered monitoring approach consisting of a unit monitoring program and a broader scale monitoring strategy to address monitoring questions that can best be answered at a scale broader than the unit.

Plans meeting the requirements of this alternative would more consistently provide guidance for maintaining or restoring water quality and resources and identifying stressors that have the potential to affect water quality than those prepared under the current planning regulations.

Effects to resources expressed as general outcomes over time

Based on the above discussion of the effects of the Alternative on the planning process and plan content with respect to water quality, as well as the information provided in the Affected Environment – Water Quality section of this chapter, we can provide some general statements of effects of implementing this alternative. This alternative increases the requirements for plans to include management direction for sustainable water quality and quantity relative to what is currently required. NFS lands are expected to continue to be the source of some of the cleanest water in the nation and will continue to be the

source of a significant percentage of the county's drinking water. As demand for, and stressors on, fresh, available water continue to increase, water quality and quantity both on and off NFS lands will continue to be at risk. The use of BMPs for water quality has been demonstrated to mitigate detrimental effects of other management activities on water quality and the use of BMPs will continue under all alternatives.

The requirement for a two tiered monitoring approach provides a sound framework for water quality monitoring. A broad scale approach to water quality monitoring may help to identify the sources of impacts to water quality as water moves onto, across, and then off of NFS lands. Identifying the sources of water quality impacts could lead to more rapid responses or changes in management to address point and non-point sources water quality impairment. Land management planning that recognizes the stressors to water quality on and off NFS lands as well as managing for sustainability and watersheds with ecological integrity, and protection of drinking water supplies, provide the best opportunity to maintain water quality and quantity. (Also see the description of effects to water resources under the Climate Change section of this chapter).

Modified Alternative A

The effects of Modified Alternative A are similar to Alternative A with the following exceptions:

Watershed Condition

Under Modified Alternative A, plans must include plan components to maintain or restore the ecological integrity of terrestrial and aquatic ecosystems and watersheds in the plan area, including components to maintain or restore structure, function, composition, and connectivity (§ 219.8(a)(1). In developing these plan components, the interdependence of terrestrial and aquatic ecosystems would be taken into account. All plans will include plan components to maintain or restore air quality, soils and soil productivity, water quality, and water resources in the plan area (§ 219.8(a)(2)(i-iv).

Riparian Areas

Modified Alternative A includes direction for riparian management that is a combination of the requirements of Alternative A and Alternative B. It includes the proactive approach to riparian area management of Alternative A, by requiring "plan components, including standards or guidelines, to maintain or restore the ecological integrity of riparian areas in the plan area, including plan components to maintain or restore structure, function, composition, and connectivity, taking into account:

(A) Water temperature and chemical composition;

(B) Blockages (uncharacteristic and characteristic) of water courses;

(C) Deposits of sediment

(D) Aquatic and terrestrial habitats

(E) Ecological connectivity

(F) Restoration needs; and

(G) Floodplain values and risk of flood loss." (§ 219.8(a)(3)(i))

Modified Alternative A also incorporates the mitigation requirements of Alternative B by stating: "plan components must ensure that no management practices causing detrimental changes in water temperature or chemical composition, blockages of water courses, or deposits of sediment that seriously and adversely affect water conditions or fish shall be permitted within the riparian management zones or the site-specific delineated riparian areas" (§ 219.8(a)(3)(ii)(B) and giving special attention to land and vegetation for approximately 100 feet from the edges of all perennial streams and lakes. The requirements of Alternative A to maintain, protect, and restore riparian areas represents a proactive approach to riparian area management that inherently includes limitation or mitigation of activities that could seriously and adversely affect riparian areas; as a result there is no measurable difference at the programmatic level in environmental effects between Alternative A and Modified Alternative A. The requirement to pay special attention to land and vegetation for approximately 100 feet from the edges of all perennial streams and lakes (§ 219.8(a)(3)(ii) is an additional consideration to the requirement in Alternative A to establish a default width for riparian areas around all lakes, perennial or intermittent streams, and open water wetlands, within which plan components will apply. This additional consideration is not expected to result in different programmatic effects.

Water Quality

Modified Alternative A requires the Chief to establish requirements for national BMPs for water quality in the Forest Service Directive System (§ 219.8(a)(4)). Plan components must ensure implementation of these practices. As stated in the Affected Environment – Water Quality section above, the National Core BMPs are anticipated to be published as an Agency Technical Guide by end of CY2011 along with revised national direction in draft by the end of FY2012. The revised national direction will be subject to public comment. Implementation of the national direction will occur under all alternatives; however under Modified Alternative A, the requirement for implementation will also be consistently included in plans.

Alternative B (No Action)

Watershed Condition

Effects on plan content and the planning process

Alternative B does not include requirements for developing plan components specific to watershed restoration, but instead requires adoption of measures to minimize risk of flood loss, to restore and preserve floodplain values, and to protect wetlands (§ 219.23(f)). Alternative B also requires compliance with the requirements of the Clean Water Act, the Safe Drinking Water Act, and other procedural requirements with respect to the provision of public water systems and the disposal of waste water (§ 219.23(d)). In addition, it requires the evaluation of existing or potential watershed conditions that will influence soil productivity, water yield, water pollution, or hazardous events (§ 219.23(e)).

Alternative B largely prescribes actions to mitigate the effects of other activities, mainly timber harvest, on aquatic resources (§ 219.14).

Nothing in Alternative B precludes plans from including plan components for maintaining or restoring watershed condition and many recently revised plans do include these types of components. However, based on the review of recently revised plans, plans created or revised under this alternative would be expected to vary in the degree to which they address watershed condition. The general trend in Forest Service management is toward an emphasis on watershed protection, maintenance and restoration. This is expected to continue to shape land management plans, projects, and activities on NFS lands. Under all alternatives the restoration of watersheds is expected to continue as a core management objective of National Forests and Grasslands. The Forest Service is expected to continue to prioritize watersheds for restoration and to track watershed condition.

The Agency's increased emphasis on improving watershed conditions and assessing changing conditions can be expected to continue, and future plans are likely to reflect that emphasis. However, there is a greater degree of uncertainty of that under this alternative than under Alternatives A, Modified A, D, or E.

Effects to resources expressed as general outcomes over time

Alternative B is the existing condition. To the extent that the 1982 planning rule has affected current conditions, the USDA Forest Service:

- Manages 193 million acres of national forests and grasslands that contain approximately 400,000 miles of streams, 3 million acres of lakes, and many aquifer systems that serve as the largest source of drinking water in the contiguous United States.
- Administers more than 90,000 water rights in cooperation with states.
- Protects and improves habitat for more than 550 rare, threatened, and endangered aquatic species.
- Provides outdoor recreation to more than 130 million visitors per year near streams, lakes, and other water resources.
- Supports access and operations for more than 200 hydroelectric facilities (Furniss et al. 2010).

While many uses and stressors on NFS watersheds have increased since the 1982 rule was adopted (water withdrawals, rate of climate change, recreation, uncharacteristic wildfire), other uses have decreased (road building, timber harvest and grazing). See sections on Climate Change and Multiple Uses of this chapter. At a national scale, it is difficult to predict what the net effects of these changes will have on watershed condition in the future.

This alternative does not emphasize collaborative watershed restoration or landscape level restoration, though the examples of the use of collaborative, landscape level approaches displayed under Alternative A and Modified Alternative A have all occurred

while the existing regulations have been in place. Collaborative landscape or watershed projects involving other landowners and managers are expected to continue to occur under all alternatives. However, under Alternative B, the likelihood that this approach will be consistently incorporated into land management planning is less certain.

It is possible, although unlikely, that some plans created or revised under this alternative could take a mitigation approach rather than an active restoration approach. In times of changing climate and ever increasing stressors, watershed conditions could be expected to deteriorate under a strictly mitigative approach, particularly where natural disturbance patterns are absent. Under a mitigation approach, watersheds currently in poor condition would remain in poor condition or might degrade further.

Road System

Effects on plan content and the planning process

Alternative B requires that management prescriptions are to provide that any roads constructed through contracts, permits, or leases are designed according to standards appropriate to the planned uses, considering safety, cost of transportation, and effects upon lands and resources (§ 219.27(a)(10)); and that roads are planned and designed to re-establish vegetative cover on the disturbed area within a reasonable period of time (10 years) unless the road is determined necessary as a permanent addition to the National Forest Transportation System (§ 219.27 (a)(11)). Both of these requirements are required for all alternatives, as they are requirements of section 10 of NFMA (16 U.S.C. 1608); however, the 1982 rule restates those requirements within the rule. This Alternative requires the evaluation of existing or potential watershed conditions that would influence soil productivity, water yield, water pollution, or hazardous events and adoption of measures, as directed in applicable executive orders, to minimize risk of flood loss, to restore and preserve floodplain values, and to protect wetlands (§ 219.23 (e) and (f)). This alternative includes aspects of E.O.11988 Floodplain Management for restoration and preservation of floodplain values and E. O. 11990 for protection of wetlands. These executive orders apply to all alternatives.

Under this alternative, trends and conditions described under the Affected Environment section would be expected to continue, and plans would be expected to be highly variable in what guidance they provide for managing the road system. Based on a review of recently revised plans, it is reasonable to expect that plans would include guidance on roads, the road system, or road impacts on watersheds.

Effects to resources expressed as general outcomes over time

Under Alternative B, coupled with the travel management rule and ongoing Agency and USDA policy for watershed protection and restoration, the trend of a reduced road system is expected to continue for some time. Although since this alternative does not include a watershed restoration emphasis, plan content related to the NFS road system and road management decisions are expected to be driven by rules, regulations and policy other than the planning rule. There are many variables that will affect the rate of road decommissioning, the specific roads that will be decommissioned and the resulting

effects of those activities including funding levels, the number and location of existing roads on any given unit, changes in policy, the need for access to meet multiple use needs, and the existing condition of roads or the watersheds they are in. A road system that is properly maintained should result in less impacts (sedimentation, aquatic organism passage, disruption of overland flows, etc.) of roads on aquatic and riparian resources than is being experienced today.

Riparian Area Management

Effects on plan content and the planning process

Alternative B requires that special attention shall be given to land and vegetation for approximately 100 feet from the edges of all perennial streams, lakes, and other bodies of water. This area is to correspond to at least the recognizable area dominated by the riparian vegetation. No management practices are allowed to cause detrimental changes in water temperature or chemical composition, blockages of water courses, or deposits of sediment to mitigate effects on water conditions or fish habitat (§ 219.27(e)). Topography, vegetation type, soil, climatic conditions, management objectives, and other factors are to be considered in determining what management practices could be performed within these areas or the constraints to be placed upon their performance.

Nothing in Alternative B precludes plans from including plan components for maintaining or restoring riparian areas. Based on the review of recently revised plans, plans created or revised under this alternative would be expected to vary in the degree that they address riparian areas, although plans recently revised under the provisions of Alternative B tend to exceed the minimum requirements of this alternative.

Effects to resources expressed as general outcomes over time

Based upon the effects on plan content and the planning process the information provided above and the information issue provided in the Affected Environment - Riparian Areas the following statements can be made relevant to the effects that this alternative, if implemented, would have on watershed conditions.

In many instances, especially when not coupled with plan components for active restoration of riparian areas, the 1982 provision was implemented as a 100 foot “no management” buffer. However, in the absence of natural disturbance or management activities in riparian areas that mimic natural disturbance, riparian health can decline (Everest and Reeves 2007, Pickett and Thompson 1978, Pickett and White 1986, Milly et al. 2008).

It is possible that some plans created or revised under this alternative could take a strictly mitigative approach rather than an active restoration approach to riparian management. In times of changing climate, fire suppression, and ever increasing stressors; riparian conditions could continue to decline under a strictly mitigation approach (USDA and USDI 1996).

The Agency’s increased emphasis on improving watershed conditions and assessing changing conditions can be expected to continue and future plans are likely to reflect that

emphasis; however, there is a greater degree of uncertainty of that under this alternative than under Alternatives A, Modified A, D, or E. Alternative B focuses on mitigating and avoiding adverse effects of management actions on riparian area values, but it does not emphasize restoration or maintenance of these areas.

Water Quality

Effects on plan content and the planning process

This alternative, as all alternatives, requires compliance with requirements of the Clean Water Act, the Safe Drinking Water Act, and all substantive and procedural requirements of Federal, State, and local governmental bodies with respect to the provision of public water systems and the disposal of waste water (§ 219.23(d)). At a minimum, plans would meet legal requirements as discussed previously in the Affected Environment section on this topic. Plans would reflect an evaluation of existing or potential watershed conditions that would contribute to water pollution (§ 219.23(e)). As stated in the Alternative B discussions on watershed condition and road system, above, the Agency's increased emphasis on improving watershed conditions and assessing changing conditions can be expected to continue, and future plans would be expected to reflect that emphasis. However, there would be less certainty in how or to what extent plans would provide guidance for restoring or protecting water quality.

Effects to resources expressed as general outcomes over time

The existing condition of water resources on NFS lands is a result of management that has occurred prior to the inception of land management planning and while the 1982 planning provisions have been in place. NFS lands are expected to continue to be the source of some of the cleanest water in the nation and will continue to be the source of a significant percentage of the county's drinking water. As demand for, and stressors on, fresh, available water continue to increase, water quality and quantity both on and off NFS lands will continue to be at risk. The use of BMPs for water quality has been demonstrated to mitigate detrimental effects of other management activities on water quality and the use of BMPs will continue under this alternative. The requirements of this alternative neither provide for nor preclude a proactive or adaptive framework for managing for sustainable water resources.

Alternative C

Alternative C provides the least number of specific plan requirements for management of watershed condition, road systems, riparian management, and water quality of all alternatives analyzed in detail. As a result there is greater uncertainty of what the effects to plan content and the planning process would be and in turn, the uncertainty as to potential effects to resources over time is magnified. Expectations at the plan level range from an expedited planning process producing very streamlined plans to a planning process and plans that are similar to those plans that have been recently revised using the 1982 planning provisions. At best some general statements can be made in relation to the following indicators.

Watershed Condition

The effects of Alternative C would be similar to Alternative B. Even though this alternative includes very few requirements related to watershed condition, it is not expected that plans created, revised, or amended under this alternative would include less emphasis on watershed health or condition than those revised under Alternative B. It is reasonable to expect that plans would be written consistent with current Agency policy for improving watershed condition, but that they would be highly variable in the degree to which they include guidance for protection or restoration of watersheds.

Road System

This alternative contains no direction related to roads. There are no requirements for assessment, development, or monitoring of plan components to address watershed structure, composition, and function. Under this alternative there is more uncertainty than under Alternatives A, Modified A, D and E as to what guidance, related to the impacts of roads on watersheds and water resources, would be included in plans. Expected outcomes for Alternative C are similar to Alternative B, in that all plans would be consistent with current policy and statute and all or most plans would include guidance related to roads, but guidance could vary widely among plans. To some extent, fewer requirements for public involvement, assessment, and monitoring under this alternative compared to the other alternatives might increase the risk that the impacts of roads are not considered in developing the need to change the plan or are not analyzed as an issue in the environmental impact statement for plan revision even where impacts are occurring.

Riparian Area Management

This alternative includes requirements for mitigation specific to timber production activities such that protection would be provided for streams, stream banks, shorelines, lakes, wetlands, and other bodies of water. No other protection is afforded to riparian areas (§ 219.11). The effects of this alternative on riparian areas are similar to those expected under Alternative B.

Water Quality

This alternative, similar to all alternatives, requires compliance with requirements of the Clean Water Act, the Safe Drinking Water Act, and all substantive and procedural requirements of Federal, State, and local governmental bodies with respect to the provision of public water systems and the disposal of waste water. Plans would meet minimum legal requirements as discussed previously in the Affected Environment section. As stated in the Alternative B discussions on watershed condition and road systems, above, the Agency's increased emphasis on improving watershed conditions and assessing changing conditions can be expected to continue, and future plans would be expected to reflect that emphasis. However, there would be less certainty than under all other alternatives as to what extent plans would provide guidance for restoring or protecting water quality.

Alternative D

Watershed Condition

Effects on plan content and the planning process

This alternative consists of the provisions of Alternative A with additional and more prescriptive requirements for watershed protection and restoration. Effects of this alternative on plan content and the planning process would be similar to Alternative A with the addition that under this alternative plans or the planning process would include:

- Watershed-scale assessments, including climate change vulnerability assessments, using the best available science to determine current and historic ecological conditions and trends (§ 219.6).
- Plan components to create and maintain spatial connectivity within or between watersheds, including lateral, longitudinal, and drainage network connections among floodplains, wetlands, upslope areas, headwater tributaries, and intact habitat refugia (§ 219.8).

Plans would identify:

- Key watersheds that are areas of highest quality habitat for native fish, amphibians, and species of reptiles, mammals, and birds known to be highly dependent on aquatic habitats (§ 219.6);
- Key watersheds across the planning unit in order to establish a network that can serve as anchor points for the protection, maintenance, and restoration of broad-scale processes and recovery of broadly distributed species.
- Spatial connectivity within or between watersheds, including lateral, longitudinal, and drainage network connections among floodplains, wetlands, upslope areas, headwater tributaries, and intact habitat refugia (§ 219.8).

This alternative requires that plans provide the highest level of emphasis on watershed analysis and watershed restoration of all alternatives.

Effects to resources expressed as general outcomes over time

Based upon the effects on plan content and the planning process in the information provided above, the analysis of effects under Alternative A and the information provided in the Affected Environment - Watershed Condition, the following statements can be made relevant to the effects that this alternative, if implemented, would have on watershed conditions

The effects of Alternative D incorporate those of Alternative A with the following additions:

Alternative D specifies many of the same elements for watershed management as the Northwest Forest Plan (USDA Forest Service and USDI Bureau of Land Management, 1994) and the Tongass Land Management Plan (USDA Forest Service 2008a). Reeves et al. (2006), in discussing watersheds of the Pacific Northwest, noted that the

comprehensive forest management practices in these plans and the provisions within each strategy to use a watershed analysis to tailor plans to the individual watersheds gives a reasonable probability that ecosystem functions at large spatial scales would be maintained over the long term on NFS and Bureau of Land Management lands. Reeves et al. (2006) finds that: "In the approximately 10 years since strategy implementation, watershed condition scores changed modestly, but conditions improved in 64% of 250 sampled watersheds, declined in 28%, and remained relatively the same in 7%. Watersheds that had the largest declines included some where wildfires burned 30-60% of their area, though the overall statistical distribution of the condition scores did not change significantly. It was recognized at the outset of the ACS (Aquatic Conservation Strategy), that in many highly degraded watersheds it may take decades to see statistical improvements for some parameters."

This alternative capitalizes on approaches that have been demonstrated to work in some areas of the country – largely the Pacific Northwest. However, it is uncertain how effective in improving watershed conditions a single, prescriptive approach would be if implemented across the highly diverse watersheds of the NFS. The fragmented ownership and/or low percentage of ownership within individual watersheds on many eastern forests may make the requirements of this alternative a less effective or efficient approach for maintaining and restoring watersheds. For example, the Mark Twain National Forest consists of several relatively small administrative units all separated by other land ownerships. The Finger Lakes National Forest is approximately 16,000 acres and contains small portions of eight fifth code subwatersheds. It is unlikely that requiring these plans to establish networks that can serve as anchor points for the protection, maintenance, and restoration of broad-scale processes and recovery of broadly distributed species and to maintain spatial connectivity within or between watersheds, including lateral, longitudinal, and drainage network connections among floodplains, wetlands, upslope areas, headwater tributaries, and intact habitat refugia would be the most effective management strategies for improving watershed conditions on these units. To design effective adaptation measures, important differences and distinctions are ideally assessed by managers at management relevant scales, especially at the sub-basin, watershed, and subwatershed scales (USGS and NRCS 2009).

This alternative is consistent with Agency policy for setting priorities for watershed restoration. The required criteria for identifying key watersheds under this alternative are not completely analogous to Agency policy, though some of these same criteria may well be used to identify priority watersheds, for instance. It is highly uncertain as to how differences in criteria for selecting key or priority watersheds would affect watershed condition across all NFS units. The Agency currently uses the WCF to prioritize watersheds for restoration and maintenance. The WCF includes 12 indicators that can be weighted to match unique characteristics of individual units. The WCF is a relatively new tool and is expected to be adapted over time based on experience gained through implementation and as new information becomes available.

Under Alternative D, new or revised plans would more consistently include direction for maintenance and restoration of watersheds and more protection for aquatic resources than current plans. Some of the requirements of Alternative D might be more suited to certain

geographic areas (e.g., the Pacific Northwest) than others (eastern continental United States). The lack of flexibility could result in plans or planning processes that less effectively address local watershed issues. Plans designed to meet the requirements of Alternative D would be expected to lead to projects designed to protect or more proactively maintain or restore watershed condition rather than simply to mitigate the effects of other activities. Watershed conditions would be expected to improve over time.

Road System

Effects on plan content and the planning process

This alternative consists of the provisions of Alternative A with additional and more prescriptive requirements related to the road system (§ 219.8). Under this alternative the plans would include standards and guidelines for:

- Road densities in key watersheds to achieve sediment reduction, minimized alteration of surface and subsurface flows, and connectivity of aquatic and riparian habitat.
- Road removal and remediation in riparian conservation areas and key watersheds as the top restoration priority.
- Achieving the identified minimum necessary road systems as required by the travel management rule, at 36 CFR 212.5(b)(1) and (2).

This alternative requires that all plans for all units include standards and guidelines for road decommissioning in riparian areas as the top restoration priority. It is unlikely that road decommissioning is the top restoration priority for all units. In addition, standards and guidelines require plan amendments to change. Plan amendments are at times contentious and at times take a long time to complete. Restoration priorities (such as public safety, habitat for threatened or endangered species, or restoration of riparian vegetation) are site- and time-dependent. Plans that include national standards can quickly become outdated as conditions change.

Effects to resources expressed as general outcomes over time

Alternative D includes specific direction related to roads, including establishing standards and guidelines for road densities in key watersheds. The effects of this alternative related to the road system are similar to that of Alternative A. It is uncertain what additional effects, positive or negative, the additional provisions of this alternative would have on watershed condition across all units. Road density standards alone might not be effective in addressing the greatest resource impacts (Verry and Dolloff, 2000), and density is not always a reliable indicator of impacts. Also see discussion of disagreement in the literature regarding the direct cause and effect relationship between road density and water and aquatic habitat quality – Affected Environment - Road System of this section. In some instances, placing an emphasis on reducing road density could skew selection of roads to be decommissioned toward areas where the most miles can be decommissioned with available funds rather than those that have the greatest impacts (Anderson 2010). Many roads on eastern forests have mixed ownerships with a mixture of Forest Service,

local government, county, State roads, and Federal highways. In watersheds where the percentage of NFS land or road ownership is low, setting maximum road density standards for NFS roads could be an ineffective tool for maintaining and restoring watershed condition in other watersheds is may be an effective option. The requirements of the travel management rule (36 CFR 212.5(b)(1) and (2)) remain under all alternatives. Reductions in road density will continue to be an emphasis under this and all alternatives. A road system smaller than current the NFS road system has less potential to negatively affect aquatic resources, however the requirements in this alternative specific to the road system are unlikely to lead to differences in effects between this alternative and the no action alternative and on some units, may hamper the ability to react to changing conditions or set priorities that meet the restoration needs of individual watersheds.

This alternative also requires that road removal or remediation in riparian conservation areas and key watersheds be considered a top restoration priority (§ 219.8). Setting restoration priorities for all units does not take into account the high variability of conditions and stressors across NFS lands. Also, it does not take into account changing conditions. While road remediation in riparian areas could be the highest priority in some places or at some times, it might not be for all units and across the entire life of a plan. For example, it might be more important to shift restoration focus to control of a new occurrence of invasive species before it becomes pervasive in a watershed, rather than removing roads in riparian areas.

There is less ability to react quickly to changing conditions in this alternative relative to other alternatives. The delayed response time may mean that other resource needs may be unaddressed for longer times. The requirements of this alternative may result in plans that effectively address resource concerns in some areas and may hamper the ability to address resource impacts in other areas.

Riparian Area Management

Effects on plan content and the planning process

This alternative consists of the provisions of Alternative A with additional and more prescriptive requirements for riparian area management. Effects of this alternative on plan content and the planning process would be similar to Alternative A with the addition that under this alternative the plans or the planning process would include specific requirements for riparian area management, including:

- establishment of riparian conservation areas with default widths of a minimum of 100 feet until the actual riparian conservation areas are delineated (§ 219.8).
- completion of watershed assessments to refine default conservation area boundaries and develop monitoring programs.
- standards and guidelines that require management activities within riparian areas to be primarily for restoration, and those that are not for restoration (e.g., construction of new facilities such as roads, trails, boat landings, etc.) would be designed to minimize impacts to ecological function.

Establishing a default width is a fairly accepted practice and while default widths may be greater than 100 feet, this alternative doesn't allow narrower widths based on geomorphic features, conditions, or type of water bodies. It is recognized that a national standard setting a minimum default width applicable to all types of waterbodies and in all geomorphic settings is not entirely consistent with the scientific literature which largely argues for scalable widths, widths tailored to geomorphic settings or an adaptable approach matched to resource characteristics. The national standard provides certainty or assurance that riparian areas of 100' or less would be fully incorporated within the riparian conservation area. However, to expand the default width beyond 100' will require a "burden of proof" during the planning process that some units may not be willing or able to accomplish. Reeves et al. (2006) found that the initial widths of riparian reserves [of the Aquatic Conservation Strategy in the Northwest Forest Plan] were expected to be interim and activities within them very restricted until a watershed analysis was completed. It appears, however, that the interim boundaries of the riparian reserves remained intact in the vast majority of watersheds (Baker et al. 2006). One reason given for this was that the burden of proof for adjusting the boundaries was too high. No explicit criteria for changing the boundaries were established by the Northwest Forest Plan ROD (USDA Forest Service and USDI Bureau of Land Management 1994) other than to require that those proposing to undertake activities within the riparian reserves demonstrate that the actions would not have negative effects. In some ecological settings 100' may be far more than is required for adequate protection and restoration of riparian and aquatic resources, providing a level of conflict and an over commitment of resources at the time of plan revision. The under or over commitment of resources is common to all alternatives that require an establishment of default width; however the likelihood is higher under this alternative than under those that allow for variable default widths based on geomorphic or other factors. Riparian conservation area widths could be modified based on watershed analysis or site specific delineation.

Coupled with the requirement that only restoration activities occur within the conservation areas, the level of analysis and the controversy during plan creation or amendment may be greater under this alternative than under other alternatives. Everest and Reeves (2007) state that while the key watershed reserves coupled with the interim riparian reserves in the Northwest Forest Plan have provided a connected watershed-level reserve system for terrestrial, riparian, riparian, and aquatic ecosystems, the amount of forested landscape protected by these strategies has fueled the controversy regarding riparian protection and resulted in both new research to evaluate prescribed buffer widths, and a re-examination of existing scientific literature on the subject.

Effects to resources expressed as general outcomes over time

Based upon the effects on plan content and the planning process the information provided above, the analysis of effects under Alternative A and the information issue provided in the Affected Environment - Riparian Areas, the following statements can be made relevant to the effects that this alternative would have on watershed conditions

The effects of Alternative D incorporate those of Alternative A with the exception of the following:

The requirements for riparian area management are similar in nature to those of the Aquatic Conservation Strategy (ACS) of the Northwest Forest Plan. The effects are therefore likely to be similar. In 2006, it was found that in "the approximately 10 years since [ACS] implementation, watershed condition scores changed modestly, but conditions improved in 64% of 250 sampled watersheds, declined in 28%, and remained relatively the same in 7%. Watersheds that had the largest declines included some where wildfires burned 30-60% of their area. The overall statistical distribution of the condition scores did not change significantly, however. Much of the increase in watershed condition was related to improved riparian conditions. The number of large trees (>51 cm diameter at breast height) increased by 2-4%, and there were substantial reductions in tree harvest and other disturbances along streams. Whether such changes will translate into longer-term improvements in aquatic ecosystems across broader landscapes remains to be seen." (Reeves et al. 2006).

While this alternative provides the highest level of protection for riparian areas of all of the alternatives analyzed in detail, it is not without tradeoffs. With limited exceptions, activities, practices, and uses that are not demonstrably restorative would be excluded from riparian areas. Under the ACS there are an estimated 2,627,500 acres of riparian reserves. Riparian Reserves and their appurtenant standards and guidelines also apply where these reserves overlap with any other land allocations. Acres of Riparian Reserves within other land allocations is not calculated, but is estimated to encompass 40 percent (based on a sample) of those allocations. The percent of area in Riparian Reserves varies markedly among administrative units, from a high of approximately 74 percent on the Siuslaw National Forest, to a low of approximately 4 percent on the Deschutes National Forest. (Attachment A to the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl)(USDA Forest Service and USDI Bureau of Land Management 1994).

As these plans are implemented, riparian areas that are currently in good condition would be expected to be maintained, and riparian areas in degraded conditions would be expected to improve at a faster rate than under other alternatives.

Water Quality

Effects on plan content and the planning process

The effects of this alternative are similar to those under Alternative A. Also see effects displayed under Watershed Protection, Riparian Areas, and Road System. In addition, this alternative requires plans to include standards and guidelines for protection, maintenance, and restoration of a natural range of variability in sediment regime. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport (§ 219.8).

Effects to resources expressed as general outcomes over time

While an understanding of the natural range of variability in sediment regime could provide important context for sediment reduction activities, standards to restore sediment regimes to a natural range of variability might be impractical as they require information

on historical flow regimes that might not be applicable to future conditions. (See previous discussions in the Chapter 3 on Historical Range of Variability as a Way of Understanding the Historical Nature of Ecosystems and Their Variation and Stressors and Their Influence). Using historical ranges of variation as standards or guidelines for restoration may be inappropriate in the face of changing climates. Re-alignment with current process and dynamics may be more effective in facilitating recovery and adaptation to changing climate than restoration to historic pre-disturbance conditions (Millar and Brubaker 2006, Joyce et al. 2009).

The added requirements might also not be appropriate for all NFS units, will be data intensive, and might constrain or delay other management actions that could address known sediment problems.

Based upon the effects on plan content and the planning process the information provided above, the analysis of effects under Alternative A and the information issue provided in the Affected Environment - Riparian Areas, the following statements can be made relevant to the effects that this alternative, if implemented, would have on water quality.

As described in Alternative A, the requirement for a two tiered monitoring approach provides a sound framework for water quality monitoring. A broad scale approach to water quality monitoring may help to identify the sources of impacts to water quality as water moves onto, across, and then off of NFS lands. Identifying the sources of water quality impacts could lead to more rapid responses or changes in management to address point and non-point sources water quality impairment. Land management planning that recognizes the stressors to water quality on and off NFS lands as well as managing for sustainability and watersheds with ecological integrity, and protection of drinking water supplies, provide the best opportunity to maintain water quality and quantity. (Also see the description of effects to water resources under the Climate Change section of this chapter). The requirements for riparian protection should have a positive effect on water quality beyond those described in Alternative A. The requirements in this alternative for standards and guidelines for protection, maintenance, and restoration of a natural range of variability in sediment regime are likely to add process, but are unlikely to achieve greater protection for water quality.

Alternative E

Watershed Condition, Road System, Riparian Area Management, and Water Quality

The effects of Alternative E on watershed condition, the road system, riparian area management, and water quality would be the same as Alternative A with two exceptions. This alternative calls for more detailed monitoring of indicators and signal points for measuring effectiveness of management actions (§ 219.12). This alternative would provide more abundant information on potential cause-and-effect relationships of land management activities on the environment, and this might result in better information available for adaptive management decisions. Predictions of future climate scenarios and effects vary widely, and this uncertainty requires managers to accommodate variation and uncertainty to be able to assess potential outcomes. Adaptive actions taken early can

minimize potential undesirable impacts. Enhancing the effectiveness of observation networks and current monitoring networks would provide information for the early detection of ecological change associated with climate change (CCSP 2008b). Monitoring plans, including signal points, developed under this alternative could provide a more effective mechanism for adaptive management than current monitoring plans. However, the level of effort and funds this would require is significant. Resources shifted toward monitoring would be at the expense of other management activities.

Alternative E also includes specific requirements for a public participation process beyond those required by Alternative A. Additional requirements for outreach to traditionally underserved communities (§ 219.4) might result in plans that reflect a broader spectrum of public values concerning watershed condition, riparian areas, and water quality, but it is not clear that collaboration processes required by this alternative would necessarily result in a greater degree of inclusion than Alternatives A or D. See Transparency and Collaboration section this chapter.

CLIMATE CHANGE

Affected Environment

Scientific Findings About Climate Change

The Intergovernmental Panel on Climate Change (IPCC) is the leading international body for the assessment of climate change. It was established by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) to provide the world with a clear scientific view on the current state of knowledge in climate change and its potential environmental and socio-economic impacts. The UN General Assembly endorsed the action by WMO and UNEP in jointly establishing the IPCC. The IPCC is a scientific body. It reviews and assesses the most recent scientific, technical, and socio-economic information produced worldwide relevant to the understanding of climate change.

The IPCC (2007) concluded that earth's climate has been undergoing a warming trend, with increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level. There have also been changes in the patterns of precipitation. The IPCC concluded that it is *very likely*[3] that over the past 50 years, cold days, cold nights, and frosts have become less frequent over most land areas, and hot days and hot nights have become more frequent. It is also *likely* that over most land areas heat waves have become more frequent and that heavy precipitation events have also become more frequent. There is *very high confidence* that recent warming is strongly affecting terrestrial biological systems including such changes as earlier timing of spring

[3] The IPPC uses the following phrases to express uncertainty that are used in this section:
Very likely: greater than 90 percent probability of occurrence;
Likely: greater than a 66 percent probability of occurrence;
Very high confidence: a 9 out of 10 chance of being correct.
High confidence: an 8 out of 10 chance of being correct.

events, such as leaf unfolding, bird migration and egg laying and movement toward upper latitudes and higher elevations in ranges of plant and animal species. There is also *high confidence* that observed changes in freshwater biological systems, such as changes in algal and zooplankton abundance in high latitude and high elevation lakes and changes in range migration patterns of fish in rivers, are associated with rising water temperatures and related effects such as changes in ice cover, oxygen levels, and circulation (IPCC 2007).

The global average temperature since 1990 has risen by about 1.5° F and the U.S. average temperature has risen more than 2° F in the past 50 years (USGCRP 2009). Precipitation in the United States has also increased an average of 5 percent over the past 50 years (USGCRP 2009). These changes have been experienced differently across the country. For example, in the Northeast, since 1970, the annual average temperature has increased by 2° F, with winter temperatures rising twice as much (USGCRP 2009). In the Southeast, the number of freezing days has declined by 4 to 7 days per year for most of the region since the 1970s, and average autumn precipitation has increased by 30 percent since 1901 (USGCRP 2009). Alaska's temperature has increased at a rate higher than the rest of the country. Over the past 50 years, that State's annual average temperature has increased 3.4° F, while winters have warmed by 6.3° F (USGCRP 2009). Thus, Alaska is already experiencing impacts from climate change at higher levels than other regions, such as earlier spring snowmelt, reduced sea ice, widespread glacier retreat, and permafrost warming (USGCRP 2009).

By 2100, the global average temperatures is projected to rise another 2 to 11.5° F; by the end of the century, the average U.S. temperature is projected to increase by 7 to 11° F under the high emissions scenario and 4 to 6.5° F under the lower emissions scenario (USGCRP 2009). These ranges vary owing to differences among climate model results for the same emissions scenarios.

Just as changes in temperature and precipitation have already varied across the country, the projected impacts vary as well. Temperatures in the Northeast are projected to rise 2.5 to 4° F in winter and 1.5 to 3.5°F in the summer over the next several decades, while in Alaska temperatures are projected to rise about 3.5 to 7° F by the middle of the century (USGCRP 2009). Impacts on water sources will be important to many regions, particularly in the West; declines in mountain snowpack will be more important to the West and Alaska where snowpack provides natural water storage. Coastal areas will be more concerned with projected impacts to sea level rise and storm surge. The Great Plains will likely see more storm impacts, such as more severe thunderstorms, tornadoes, and hail than other regions.

Threats to Ecological Integrity

The health, diversity, and productivity of the Nation's forests and grasslands are connected and sustained through the integrity of the ecosystems on the land, and climate change places those ecosystems at risk. In the past 20 years, some of the most urgent natural resource management challenges have been driven in part by climate change, and future challenges are expected to be even more severe (USDA Forest Service 2010j).

Climate change is projected to exacerbate the impact of existing and legacy stressors on national forest and grassland ecosystems (CCSP 2008a). However, climate change impacts on ecosystems will vary; some ecosystems might experience minor changes while others might cease to exist and be supplanted by other ecosystems (USDA Forest Service 2010j). Similarly, impacts on water will vary, and desired ecosystem functions might decline in some watersheds but not in others.

The Climate Change Science Program (CCSP 2008a), now known as the Global Change Research Program, which coordinates and integrates federal research on changes in the global environment, has described changes to forests and grasslands that are expected with climate change. Increasing temperatures and changes in precipitation patterns are expected to result in declining snowpack, earlier snowmelt, increased rain rather than snow in the mix of precipitation, and advances in the timing of spring runoff and summer reductions of streamflow. Increased frequency and intensity of extreme precipitation events appear to have already affected watersheds and ecosystems throughout the United States. Water shortages are projected in some parts of the country, and ecosystems in the arid parts of national forests and grasslands are expected to be particularly affected. In wetter regions, the combinations of higher temperatures and high evapotranspiration rates could limit the water available for streamflow and human uses (Sun et al. 2005). These projected changes in temperature and hydrology are expected to affect fish habitat and shifts in the distribution of fish and other aquatic species (Kling et al. 2003). Ecosystems that are water-limited could lose productivity. Ecosystems that are limited by temperature appear to have responded positively with increasing temperature over the past 100 years (McKenzie et al. 2001). However, over the long term other factors could become more limiting or the effects of temperature could become negative when there are sustained temperature increases, especially in moisture-limited systems (McKenzie et al. 2001). The assemblage of species is expected to change in some ecosystems. Species that might currently be limited from moving to more northerly or mountainous areas because of temperature could be able to expand their ranges into areas in which they could not previously survive. Already there have been northward shifts in the ranges of several plant and animal species resulting from the reduction of cold-temperature restrictions (Parmesan 2006). Climate change would facilitate the movement of different species into new species assemblages, especially during post-disturbance succession. Species particularly at risk as a result of climate change are those that are rare, threatened, endangered, narrowly distributed, endemic, or have limited dispersal ability (Pounds et al. 2006).

Some studies suggest that climate change will cause a biome shift in the future, rather than act as a stressor on ecosystems. The change in types of vegetation present in an ecosystem can potentially entirely change the biome of an area and shift the global location of biomes (Gonzalez et al. 2010). The potential for climate change to result in entire biome shifts is uncertain, however, because of the other uncertainties surrounding climate change and its impacts and the need for more studies on the topic.

Expected future climate scenarios might increase vulnerability to wildland fires. This could be through an increased length of the fire season, greater size and intensity of

wildland fire, and more area that is vulnerable to fire. Also, climate change is expected to increase fuel loading and consequently affect fire behavior (CCSP 2008a).

Insect and disease outbreaks could become more frequent as warmer temperatures accelerate their life cycles (CCSP 2008a). Forest diebacks caused by such outbreaks in turn increase fuel loading and subsequent fire risk. Some invasive species might become more vigorous with the expected climate and associated atmospheric composition changes. For example, the expansion of some invasive species has been attributed to the rising atmospheric carbon dioxide in the 20th century (Ziska 2003). Because many invasive species might benefit from climate change more than endemic species (Dukes and Mooney 1999), the structure, composition and function of ecosystems may be affected.

While climate change could exacerbate individual stressors, these stressors have synergistic interactions. Disturbances such as wildfire, drought, and insects often influence each other. For example, drought often leads to insect outbreaks, disease, or fire. Insects and disease can also create large fuel loads and thereby contribute to increase fire frequency (National Assessment Synthesis Team 2001). Outbreaks of insects and diseases can alter natural cycles and disturbance regimes, such as nutrient cycles, and fire frequency and intensity (Mack and D'Antonio 1998). Multiple climate change-related stresses have the potential to create feedback loops that reinforce trajectories of change in disturbance regimes and related alterations of ecosystem structure and function (Keeton et al. 2007). These disturbances, along with other climate-related impacts, may also impact carbon storage potential.

National Forest System lands may also have the ability to mitigate the impacts of climate change through carbon sequestration and storage. This concept is discussed further in the Uncertainties About Climate Change section below.

Threats to Social and Economic Conditions

Social and economic conditions may be affected by a changing physical and biological environment. It is difficult to predict specifically what impacts climate change will have on social and economic conditions due to existing uncertainties surrounding some of the physical impacts to climate change. Additionally, social and economic conditions will continue to be affected by stresses other than climate change, such as other sources of environmental change, population growth, economic growth, and technological change, which could influence the impact climate change has on these conditions. Some examples from the literature of possible changes to social and economic conditions due to climate change are described below.

Forests provide a range of goods and services important to society, including raw material for wood and paper products, in addition to many non-consumptive values and uses (CCSP 2008b). A changing climate will alter forests and their ability to provide these goods and services at current levels (CCSP 2008b) and may have an impact on commercial forestry. Expected changes in productivity of forests and grasslands (CCSP 2008a) could affect opportunities to use wood for biofuels or wood products and forage for grazing livestock.

Climate change will affect different segments of society in different ways because of varying exposures and adaptive capacities (USGCRP 2009). Additionally, the impacts of climate change can be exacerbated when climate change occurs in combination with the effects of an aging and growing population, pollution, poverty, and natural environmental fluctuation (USGCRP 2009). Changes in temperature, precipitation, sea levels, and extreme weather events increasingly affect homes, communities, water supplies, land resources, transportation, urban infrastructure, human health, and regional characteristics (USGCRP 2009). Outdoor recreation will likely be altered by changes in seasonality of climate and air and water temperatures (National Assessment Synthesis Team 2001). Secondary impacts of environmental changes, such as increased haze with increased temperatures and degraded aquatic habitats, will also likely affect outdoor recreation opportunities (National Assessment Synthesis Team 2001).

Climate change could affect the recreational and tourism industries in different ways; trout and other cold-water fishing may end in New England and other northern areas. Summer recreational opportunities may increase in some northern and mountainous areas, while downhill skiing is very likely to decrease with fewer colder days and reduced snowpack (Bloomfield 2000). Winter recreation is likely to be affected by climate change, as might be the businesses associated with them. Warmer winters will shorten the average ski and snowboard seasons, increase artificial snowmaking requirements, and drive up operating costs (USGCRP 2009).

Fluctuating reservoir and stream levels will influence the quality and availability of recreational boating in a changing climate, but these effects are likely to vary widely by region. Since water provides an essential element for outdoor recreation activities, reductions in stream flows could also have negative impacts on hiking, mountain biking, and backpacking opportunities (Morris and Walls 2009).

The impacts on wildfire as described above may have an effect on social and economic conditions. Suburban expansion into partially or fully forested areas in fire-prone regions brings people and property into direct conflict with systems where fire is both natural and frequent (Keeton et al. 2007). Climate-related fire risks have the potential to compound the present fire management problem along the urban-wildland interface (Keeton et al. 2007).

Recreation is vulnerable to disruption from wildfire because people often recreate in environments and seasons with high fire risks. The effects of fire on recreation can vary; prescribed fires that are closely monitored may not impede recreation activities, whereas uncharacteristic stand-altering fires can close off popular areas for months or even years. Even if burned areas are not closed to recreation, fire can degrade them to a point where they are less attractive for users. Fewer visitors can, in turn, have a negative impact on local economies for which recreation is a valuable input (Morris and Walls 2009).

In mountainous landscapes, where scenery and sightseeing are prominent attractions, warmer lowland temperatures will tend to attract more people to the relatively cooler higher elevations. Yet climate change could affect haze and could diminish the vividness of fall foliage and color displays (Irland et al. 2001).

Changes in water availability could affect the amount and timing of water available for agriculture, industry, or human consumption, especially in arid regions. Surface water quality and groundwater supply will also be impacted by climate change. Changes in water supply availability for economic activities and environmental uses are likely to be affected by changes in average temperature and precipitation, as well as by altered frequency of extreme events such as floods and droughts (National Assessment Synthesis Team 2001). Climate-induced changes to the water cycle are expected to adversely affect energy production, human health, transportation, agriculture, and ecosystems (USGCRP 2009). Drinking water supplies are likely to be directly affected by sea-level rise in coastal areas; periodic storm surges can also affect water quality and these are likely to be exacerbated by rising sea levels in a warming climate (National Assessment Synthesis Team 2001).

Climate change may also have an impact on agricultural production. While some regions may experience a longer growing season as a result of increased temperatures, there could be negative impacts as a result of disease-causing pathogens, insect pests, and weeds (USGCRP 2009). Agricultural crops in some regions will be negatively affected by increasing temperatures and limited water supplies. Livestock production is projected to become more costly as higher temperatures stress livestock, decreasing productivity and increasing costs associated with the needed ventilation and cooling equipment (USGCRP 2009).

Uncertainties About Climate Change

There is much we do not know about how the climate will change and how a changing climate will affect the environment. Uncertainty is a result of a lack of knowledge of how climate will respond to the changing chemistry of the atmosphere, and how the atmosphere will change in the future. There are many climate change models in use and they vary considerably in their assumptions and the strength of different feedback mechanisms. As a result, managers may be faced with a wide range of potential outcomes for a given climate scenario. The level of emissions varies among scenarios due to differences in assumptions about population, economic activity, choice of energy technologies, and other factors (USGCRP 2009).

There is also uncertainty regarding the down-scaling of global climate scenarios to regional and sub-regional scales. Climate change models appear accurate only at global to continental scales (IPCC 2007), although to be useful to managers it will be necessary to down-scale models and information. At local to regional scales and on timeframes up to a few years, natural climate variations can be relatively large and can temporarily mask the progressive nature of global climate change (USGCRP 2009).

One source of uncertainty is the role that ecosystems will have on the chemical composition of the atmosphere. Forests store large amounts of carbon in their live and dead wood and soil, and they play an active role in controlling the concentration of carbon dioxide in the atmosphere. In the United States in 2003, carbon removed from the atmosphere by forest growth or stored in harvested wood products offset 12 to 19 percent of U.S. fossil fuel emissions (the 19 percent includes a very uncertain estimate of carbon storage rate in forest soil) (Ryan et al. 2010). It is estimated that the forest lands in the

NFS store about 11.6 billion metric tons of carbon or 26 percent of the carbon stored in the forests of the United States (Heath 2010). This stored carbon is in a constant state of flux as growth in trees and other plants increases the stored carbon, while mortality of vegetation decreases it.

Existing Policy and Strategies for Climate Change

The Federal Government has developed a response to address the challenges of climate change. The response includes Executive Order 13514, which makes reduction of greenhouse gas emissions a priority for Federal agencies, with requirements for reporting on greenhouse gas emissions and reducing them. Draft guidance for consideration of greenhouse gas emissions and climate change in NEPA documents has been prepared by the Council on Environmental Quality (Sutley 2010).

Within the Forest Service and the Department of Agriculture, additional steps have been taken to address the problems of climate change. The USDA 2010–2015 Strategic Plan includes "Strategic Goal 2–Ensure our national forests and private working lands are conserved, restored, and made more resilient to climate change, while enhancing our water resources" (USDA 2010a). Performance measures for this goal include targets for increasing carbon sequestration on U.S. lands through voluntary actions, offsets, incentives, and actions on Federal lands and having all national forests and grasslands in compliance with a climate change adaptation and mitigation strategy by 2015. The Forest Service has developed a National Roadmap and Performance Scorecard for measuring progress to achieve USDA strategic goals (USDA Forest Service 2010d, 2010j). The roadmap describes the Agency's strategy to address climate change and the scorecard is an annual reporting mechanism to check the progress of each NFS unit.

The roadmap directs national forests and grasslands to develop climate change vulnerability assessments that include social impacts. Elements in the scorecard allow the Agency to determine whether assessments are being developed in a way that will help inform decisionmaking at the unit level. The roadmap directs land managers to adjust activities and decisionmaking processes to reduce the vulnerability of key resources to climate change, and the scorecard measures whether the process is underway at the unit level. The roadmap also identifies monitoring strategies and networks that the Agency can use to detect and evaluate national, regional, and local trends in the condition of resources and stressors. The scorecard measures whether those monitoring systems are being used to track climate change impacts and the effectiveness of adaptation activities at the unit level.

The USDA Climate Change Science Plan, released in December 2010, provides a guide to enable clear and consistent consideration of current and potential investments in climate change science activities. The Science Plan presents an overview of the critical questions facing the Department's agencies as they relate to climate change and offers a framework for assessing priorities to ensure consistency with USDA's role in the Federal Government's broader U.S. Global Change Research Program and related efforts (USDA 2010b). The plan identifies important roles and responsibilities for USDA agencies and areas of needs and dependencies wherein USDA agencies are reliant on other programs

for cooperation. The overarching objective of the plan is to incorporate the management of climate change challenges into the scientific missions of USDA.

Climate Change in Current Plans

The land management plans initially developed under the 1982 planning rule did not contain substantial evaluation or content related to climate change. As these plans have been revised, there has been greater recognition of climate change and its influence. The recent Tongass Land Management Plan amendment (USDA Forest Service 2008a) and the Beaverhead-Deerlodge Land Management Plan revision (USDA Forest Service 2009a) incorporate considerations of climate change, primarily in their environmental impact statements. These are the most recent plan revisions and reflect substantial consideration of climate change, including evaluations of climate change as previously described—influence on fire regimes, hydrologic influences, vegetation composition, and influence on the species within those plan areas. Examples of how climate change has been incorporated directly into the revised plans include a plan that calls for maintaining the diversity of plant and animal communities to enhance their resiliency in response to changing conditions and a plan that includes climate-related monitoring questions. While consideration of climate change is starting to be addressed during the plan revision process, most of the existing land management plans do not include consideration of climate change.

The Forest Service has also prepared guidance for the consideration of climate change in land management planning and preparation of environmental documents for plans and projects (USDA Forest Service 2009b, 2010e). This guidance sets a level of consistency for plan revisions. A few key expectations identified in this guidance for plan revisions are:

- Plan revisions will use the best available science on climate change relevant to the planning unit, by using the science and projections at the lowest geographic level that is scientifically defensible. Forest Service regions and research stations are expected to collaborate to provide a common synthesis for use in planning.
- Planning units are expected to identify the risks and vulnerabilities of ecological adaptation that are expected on the planning unit. This includes ecosystems most at risk from climate change.
- Planning units are expected to include a basic analysis of conditions and trends of carbon stocks and fluxes on the planning unit and greenhouse gas emissions influenced by the management of the planning unit.
- Information resulting from the evaluation of climate change will be used in the plan to focus on risks posed by the effects of climate change to the sustainability of the planning unit.

Given current and evolving direction on climate change, it is expected that increased attention will be placed on climate change issues in both the land management plans and other activities of the Forest Service. Changes in law, regulation, or policy, and technical and financial capabilities, could further affect how the Forest Service will: (a) evaluate

climate change in its planning, and (b) develop plans that include more content on managing the influence of climate change than they do currently.

Expected Conditions and Trends

Changing climate puts additional stress on ecosystems and as a result has exacerbated conditions such as wildland fires, changing water regimes, and expanding insect infestations. Future impacts of climate change are projected to be even more severe (USDA Forest Service 2010j). The projected impacts of climate change are described in the Affected Environment for this section under Threats to Ecological Integrity and Threats to Social and Economic Conditions. The general trends of increased attention to climate change resulting from scientific research, laws, regulations, previously mentioned policies, litigation, and public concern are likely to continue in the future. Continued emissions and warming are projected for the future (IPCC 2007), which would continue to induce the changes described above.

On the ground, many of the options described for managing climate change are becoming part of the regular management of national forests and grasslands. These include providing for habitat refugia that can persist in changing climates; maintaining or restoring connectivity in both aquatic and terrestrial habitats; reducing stand densities to cope with drought stress and risk of wildfire and insect and disease outbreaks; and replacing culverts with those capable of accommodating larger flood events. Given the policy direction that is currently in place, an even greater focus on practices that will facilitate adaptation to climate change and mitigation of climate change are expected in the future. Specifically, with the climate change roadmap and scorecard in place as policy for NFS lands, it is reasonable to expect that each NFS unit would make progress in evaluating climate change vulnerabilities, developing adaptation strategies, evaluating mitigation opportunities, and monitoring the effects of climate change. Increased attention to climate change is expected to result in a more informed public and body of decisionmakers whose management decisions would produce forests and grasslands that are more resilient to climate change (see earlier discussion on Ecosystem Restoration).

Evaluation of the Alternatives

The effects of this issue are analyzed in terms of how each alternative provides a framework for understanding climate change, developing or revising plans that consider changing conditions, and monitoring to provide information that allows managers to adapt to changing conditions. Effects on resources from climate change are discussed throughout the other sections of this PEIS.

Alternative A Effects

Effects on the Planning Process and Plan Content

Alternative A establishes an adaptive management approach to address climate change through the planning framework (§ 219.5). Climate change would be addressed in all stages of the planning framework, beginning with assessment, continuing through development of the plan, and in monitoring, which would result in identification of a need to change plan components or other plan content and would inform adaptive

management on the unit. Uncertainties of climate change are expected to be addressed by a planning framework (§ 219.5) that provides for an adaptive approach to climate change including:

- An iterative process of assessment, plan decisions, and monitoring to provide feedback;
- Requirements to engage all mission areas of the Agency, including the Research and Development branch;
- Requirements for public participation in each phase of the planning framework; and
- Requirements for engaging other Federal, State, and local agencies and Tribes.

All plans would use this iterative framework to address uncertainties due to climate change.

Alternative A contains procedures and requirements to address climate change during the planning process. During assessment, the conditions and trends influencing and influenced by the planning unit would be evaluated by looking at information beyond the borders of the NFS unit. In the assessment for plan development or revision, information needed to understand and assess existing and potential future conditions and stressors would be identified and evaluated (§ 219.6(b)(1)). Coordination with the Research and Development branch of the Agency, along with other areas, would occur to consolidate existing information (§ 219.6(a)(3)).

During development of the plan components, there are multiple requirements in Alternative A that require consideration of climate change. Plans would include components to maintain or restore the ecological integrity of terrestrial and aquatic ecosystems and watersheds in the plan area, including plan components to maintain or restore the structure, composition, function, and connectivity (§ 219.8(a)(1)). In developing these plan components, many aspects would be taken into account, including the potential system drivers, stressors, and disturbance regimes (including climate change) and how they might affect ecosystem and watershed health and resilience; and including the ability of the systems on the unit to adapt to change (§ 219.8(a)(1)(ii)). The responsible official would also take into account the integration of terrestrial and aquatic ecosystems; contributions of the unit to ecological conditions within the broader landscape; and the conditions of the broader landscape that may influence the sustainability of resources and ecosystems within the plan area (§ 219.8(a)(1)(i, ii, iii)). During the development of plan components for integrated resource management, the potential impacts of climate change and other system drivers, stressors, and disturbance regimes—such as wildland fire, invasive species, and human-induced stressors—would be considered (§ 219.10(a)(9)).

Monitoring questions and associated indicators would be designed to inform the management of resources on the unit by such means as testing relevant assumptions, tracking relevant changes, and measuring management effectiveness and progress toward achieving or maintaining desired conditions or objectives (§ 219.12(a)(2)). Each unit

monitoring program would have monitoring questions or indicators for the measurable climate change influences on the unit and the carbon stored in above-ground vegetation (§ 219.12(a)(5)(v and vi)). These monitoring questions or indicators would be developed in collaboration with partners such as States, Tribes, local governments, climate scientists, and other entities with expertise in monitoring, as well as with other areas of the Agency, including Research and Development. Additionally, monitoring would occur at two levels, through a unit-level monitoring program and a broader scale monitoring strategy (§ 219.12).

Threats to ecological integrity from climate change would be addressed through the requirements listed above. It is expected that plans would be more consistent about identifying where and how the structure, composition, and function of ecosystems are maintained or restored through the desired conditions, objectives, standards, and other plan components taking into account the best scientific information on where and how climate change would affect ecological conditions. It is expected that through monitoring (unit-level and broad-scale) and assessments, shifts in ecological units or changes in ecological states influenced by climate change would be detected sooner than under the current planning rule. This would result in units being likely to amend plans more frequently than the current planning rule and adapt to climate change quicker over time.

For social and economic conditions, it is expected that, through monitoring and assessment, the planning process would more consistently be informed about potential shifts in the location and timing of multiple uses and ecosystem services and that plan components would be developed to respond to those changes.

Effects on Resources Expressed as General Outcomes Over Time

It is expected that over time the planning framework in Alternative A will result in greater recognition of the uncertainties of climate change and opportunities for a more rapid response to climate change, compared to the current planning rule. This Alternative, therefore, would provide an opportunity for better management of resources in the face of climate change.

Other Considerations

There would be some operational challenges for some requirements of Alternative A:

- The unit-level and broader scale monitoring strategy would require close coordination and additional time among the various branches of the Agency to focus on this effort. Additional time would be required to work with managers, scientists, and the public about which monitoring questions and indicators would be addressed and at what scale.
- Assessments would look beyond the borders of an NFS unit. Synthesizing information from different sources could be efficient in determining the distinctive roles and contributions of the unit, but it may be more difficult to apply the information to determine how the ecological, social, and economic requirements could be met.

Modified Alternative A Effects

Overall, the effects of Modified Alternative A will be the same as Alternative A, with the following changes to the effects on the planning process and plan content:

- Baseline assessments of carbon stocks would be evaluated during the assessment for plan development or revision (§ 219.6(b)(4)). This requirement for assessments in Modified Alternative A replaces the requirement of Alternative A to develop a monitoring question and indicator for the carbon stored in above ground vegetation. A baseline assessment of carbon stocks is currently occurring on all NFS units as part of the National Roadmap and Performance Scorecard initiative. This is expected to continue under all alternatives; however, in addition to establishing the baseline assessment, Modified Alternative A would require that a unit's baseline assessment be evaluated during the assessment for plan development or revision.
- In the assessment for plan development or revision, existing information for system drivers, including dominant ecological processes, disturbance regimes, and stressors, such as natural succession, wildland fire, invasive species, and climate change; and the ability of the terrestrial and aquatic ecosystems on the plan area to adapt to change would be evaluated (§ 219.6(b)(3)).
- The responsible official would take into account the interdependence of terrestrial and aquatic ecosystems in the plan area; contributions of the plan area to ecological conditions within the broader landscape influenced by the plan area; and the conditions of the broader landscape that may influence the sustainability of resources and ecosystems within the plan area (§ 219.8(a)(1)(i, ii, iii)).

Alternative B Effects

Effects on the Planning Process and Plan Content

Alternative B does not contain any specific procedures and requirements to address climate change. As a result, most plans and their environmental impact statements developed under the 1982 planning rule do not have any specific content about climate change. However, some of the 1982 planning rule requirements would lead to some consideration of climate change, including:

- Maintaining habitat for viable populations of native and desired nonnative vertebrate species (§ 219.7);
- Providing for tree diversity (§ 219.7); and
- Estimating timber production capabilities.

As described previously in the Affected Environment section on climate change, only in recent years has there been an increased emphasis on the consideration of climate change in planning. Given these trends, it would be expected that the analysis for a plan revision would include some assessment of climate change in the environmental impact statement or other documents. As previously described in the Affected Environment section on climate change, executive orders and policies about climate change are already part of the

emphasis of NFS management. For example, the National Roadmap and Performance Scorecard for climate change would increase the amount of information available to use during the planning process. However, how well this information would be incorporated into plans developed under the 1982 planning requirements is expected to vary among NFS units. In this context, it is to be expected—although with less certainty than under Alternatives A, Modified A, D, or E—that climate change would be a consideration in the development, revision, and amendment of plans.

Effects on Resources Expressed as General Outcomes Over Time

Because the 1982 planning rule provisions do not including requirements for climate change, plans developed under this rule would be more inconsistent in how and to what extent they address threats to ecological integrity and social and economic conditions influenced by climate change than would Alternative A, Modified A, D and E.

The 1982 planning rule does not have a planning framework designed for adaptive management, compared with Alternatives A, Modified A, D, and E. As a result, opportunities to obtain information about reducing uncertainties of climate change and opportunities for a more rapid response to climate change would not be as available as under those alternatives. It is possible to design an adaptive management approach under this rule, and some recent plans have done so. Therefore, plans would be expected to vary in whether or not adaptive management approaches to climate change would be incorporated and there would not be a consistent approach to adapting national forests and grasslands to climate change.

Plans initially created under the 1982 rule generally contained analysis only about the NFS unit, without considering information beyond boundaries. Since information technology has changed in the past 30 years, broader scale information is more readily available and most recent plans have considered such information. Yet, without a systematic approach to assessment and monitoring, there is expected to be a reduced or inconsistent rate of increased knowledge about the influences of climate change, which would decrease the opportunities for a unit's ability to address uncertainties related to climate change.

As a result of these issues Alternative B would not provide consistent opportunities for better management of resources in the face of climate change.

Alternative C Effects

Effects on the Planning Process and Plan Content

Alternative C contains only one explicit reference to climate. This requirement states that the set of plan components must identify and consider climate in the development of plan components for integrated resource management (§ 219.10(a)).

Alternative C would not provide a planning framework designed for adaptive management. Thus, the information to reduce uncertainties related to climate change would not be as available as it is under Alternatives A, Modified A, D, and E. The conditions and trends of increased consideration of climate change in planning and

management of NFS units described in the Affected Environment section on climate change would continue. However, there would be less consistency and certainty of such considerations than in those other Alternatives.

As previously described in the Affected Environment section on climate change, many of the approaches suggested for climate change are already parts of the emphasis of NFS management. The expected trends and conditions are that the Forest Service would continue to develop strategies with projects and activities that address climate change even with the reduced requirements of this alternative. The planning process would be expected to continue to include analysis, monitoring, and evaluation of future climates that could influence the plan, but there is less certainty of such analysis, monitoring, and evaluation under Alternative C than under Alternative A and Modified Alternative A, and whether or not the results of such analysis would be used to develop, revise, or amend plans.

Effects on Resources Expressed as General Outcomes Over Time

Climate change threats to ecological integrity and social and economic conditions could potentially be addressed through the requirements in this alternative. However, without more explicit requirements, the degree to which these threats would be addressed is expected to vary across NFS units.

Alternative D Effects

Effects on the Planning Process and Plan Content

The effects of this alternative are similar to the effects of Alternative A. In addition, it also contains a number of additional specific requirements for both the planning process and the plan content. Some of these requirements specifically address climate change, while others have a relationship to climate change. Among the requirements are:

- Interagency coordination of the management of planning areas to the maximum extent at the landscape level (§ 219.4(c)(2)) to:
    - Maintain viable populations of native and desired nonnative species (§ 219.4(c)(2)(i)); and
    - Develop strategies to address impacts of global climate change on plant and animal communities (§ 219.4(c)(2)(ii)).
- Watershed-scale assessments that include an assessment of climate change vulnerability. These assessments would use the best available scientific information to determine current and historical ecological conditions and trends including global climate change, ecological conditions required to support viable populations, and assessment of current and future viability of focal species (§ 219.6(b)(6)).

As described in the Affected Environment section on climate change, vulnerability assessments are consistent with science recommendations (CCSP 2008a) and current guidance for consideration of climate change in planning, although neither specifies that

vulnerability assessments for climate change should be done at the watershed scale. There might not be sufficient downscaled data to provide relevant information at the watershed scale, and therefore it could be difficult to comply with that requirement with regard to climate change. A vulnerability assessment at the watershed scale would be expected to require greater detail, which would add time and complexity, in the assessment than what is anticipated in current guidance for Alternative A.

An additional requirement for climate change vulnerability assessments at the watershed scale would provide greater assurance that information about climate change is considered compared with Alternative A.

Effects on Resources Expressed As General Outcomes Over Time

Climate change threats to ecological integrity would be addressed through the requirements listed above. With these added requirements, it would be expected that plans would be more consistent in providing direction for addressing threats to ecological integrity. Further information on the effects of Alternative D may be found in the Diversity of Plant and Animal Communities section.

With additional information about climate change, opportunities to detect and respond to changing social and economic conditions would be greater than Alternative A.

Uncertainty of climate change would be addressed by a planning framework that provides for an adaptive approach to climate change (§ 219.5), similar to Alternative A. This alternative includes requirements for monitoring and assessment that could improve a unit's ability to address uncertainties surrounding climate change. The coordination requirements of this alternative would have the potential to also address uncertainty through sharing of information with other agencies.

Alternative E Effects

Effects on the Planning Process and Plan Content

Alternative E is the same as Alternative A except that it stresses more formal public participation and includes more specific requirements for assessment and monitoring. Thus, the procedures and requirements for addressing climate change under Alternative E are the same as Alternative A, with additional requirements for monitoring and assessment. Signal points for each monitoring question would be identified and used by the responsible official to determine the need for future actions.

Alternative E expands the list of required items to be included in the assessment prior to a plan revision. An assessment for plan development or revision must assess the risks and uncertainties associated with climate change (§ 219.6(b)(1)(ii)). The unit monitoring program must also include monitoring questions or indicators on the risks and uncertainties associated with climate change in the vicinity of the planning unit to evaluate where species might need to migrate in order to maintain continued viability (§ 219.6(b)(1)(xiv)).

Effects on Resources Expressed as General Outcomes Over Time

As compared to Alternative A, there are additional required monitoring questions or indicators that would be useful in evaluating many of the effects of climate change. Each unit's monitoring program would monitor the "status of key ecological conditions affecting species of conservation concern and ecosystem diversity within each plan area, focusing on threats and stressors that might affect ecological sustainability such as management activities, invasive species, or climate change" (§ 219.12(a)(5)(ii)). There would also be increased evaluation of climate change in the assessment, which would further address threats to ecological integrity.

The expected conditions and trends, in addition to those identified in the affected environment, over time, would be greater recognition of the uncertainties of climate change through monitoring and assessment than Alternative A, and more opportunities for a rapid response to climate change through plan amendments.

Other Considerations

Additional monitoring requirements could lengthen the planning process and will increase costs. Extra time is expected to reach agreements on signal points, or thresholds before a plan could be approved.

MULTIPLE USES

National Forest System (NFS) lands contribute to community economic and social sustainability by providing a wide variety of goods and services. The national forests and grasslands contribute to communities by delivering a tremendous number of ecosystem services, ranging from clean water, biodiversity, and to carbon sequestration. For example, about 60 million people get their drinking water from water sources that originate on national forest land. The national forests contain 80 percent of the habitat for elk and bighorn sheep in the lower 48 states; 50 percent of the Nation's premiere trout and salmon habitat; and 60 percent of the developed downhill skiing terrain in this country. Another example of products that come from national forests are the Pacific yews harvested from the Gifford Pinchot National Forest in the early 1990s which yielded the first taxol, a compound used to treat various forms of cancer.

Healthy ecosystems provide a wide range of economic, cultural, environmental, and aesthetic goods and services. It is recognized that many goods are provided by forests, such as timber and specialty products such as mushrooms and medicines. Often overlooked, however, are critical forest ecosystem functions and services that contribute to supporting vibrant communities. Healthy forest ecosystems purify air and water, mitigate droughts and floods, cycle and remove nutrients, sequester or store carbon, generate fertile soils, provide wildlife habitat, maintain biodiversity, and provide aesthetic, spiritual, and cultural values.

Some people who commented on the proposed planning rule urged the Agency to remember the traditional multiple uses contained in the law. The Multiple-Use Sustained-Yield Act (MUSYA) states, "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" (16 U.S.C. 528). The National Forest Management Act effectively adds wilderness to this list (16 U.S.C. 1604(e)(1)).

Outdoor recreation, range, and timber were highlighted in scoping comments as major contributors to community jobs and income. These effects of the proposed action and alternatives on these uses and resources are discussed in this section. Effects of the alternative planning rules on management of the other multiple uses and resources in the MUSYA (i.e., watershed, wildlife, and fish) are discussed elsewhere in this chapter and therefore will not be repeated here. However, the economic contributions of wildlife- and fish-based recreation are included in the discussion of outdoor recreation in this section. Wilderness management is also included in the outdoor recreation discussion.

While the Agency does not manage subsurface minerals, mineral exploration and development does occur on NFS lands. Similarly, the Agency recognizes the growing interest in geothermal, wind, and solar energy development on NFS lands. The Agency recognizes the increased demand for energy, but must protect the renewable resources for which the national forests are managed.

Affected Environment

Outdoor Recreation

The management of recreation opportunities contributes to the essence of place and the vitality of communities. The recreation program is an important component of national forest and grassland management. Recreational use has continued to increase over the decades— Americans make more than 173.5 million visits to national forests and grasslands each year. An estimated 37 percent of visits to NFS lands involve wildlife viewing, while 8.3 percent involve hunting and 13.2 percent involve fishing. These visits provide an important contribution to the economic vitality of rural communities; spending by recreation visitors in areas within 50 miles surrounding national forests and grasslands amounts to nearly $13 billion each year. Those dollars sustain more than 224,000 full and part-time jobs. These figures account for more than half of all job and income effects attributable to Forest Service programs (USDA Forest Service 2010k).

Outdoor recreation enhances the quality of life and well-being for people, and provides opportunities to reconnect with natural and cultural settings. Connecting people to the environment is a primary emphasis of the Forest Service recreation program. Participating in outdoor recreation has been shown to reduce stress and benefit both mental and physical well-being. About one in four adults in the United States engage in recommended physical activity levels, and one in four youth (ages 12–21) report no vigorous physical activity at all. In the United States there are about 8 million children who are overweight, with obesity rates doubling for children and tripling for adolescents in the past 2 decades. Outdoor recreation touches on all aspects of health and can enhance not only physical health but also emotional well-being (Godbey 2009).

The Forest Service's National Survey on Recreation and the Environment reports that both the total number of Americans and the total number of days annually in which they

participate in nature-based recreation have increased since 2000. The nature-based outdoor activities Americans are choosing now are different from those in the past. Some forms of hunting and fishing are declining (as reported by the U.S. Fish and Wildlife Service, there were 5.2 million fewer anglers and 1.5 million fewer hunters between the years 1996 and 2006); and camping and swimming are growing more slowly now. Some other activities have declined in popularity, such as mountain biking, rafting, and horseback riding on trails. Viewing, photographing, and studying nature have grown rapidly since 2000. These activities include viewing flowers, trees, natural scenery, birds, other wildlife, and fish; and visiting nature exhibits. The expected increasing number and diversity of the U.S. population will affect future recreation patterns on the National Forest System (USDA Forest Service, Southern Research Station 2008).

The estimated total 2010 population in the United States was 310 million. The U.S. Census Bureau estimates the population will be 341 million in 2020, 374 million in 2030, and 406 million in 2040 (U.S. Census Bureau 2008a). Within 3 decades, the United States is projected to grow by 96 million people. Population and income growth, coupled with technological advances in camping and off-highway transportation, are helping to expand use of our Nation's forests and rangelands. Primary and secondary home and resort development adjoining public lands will limit general public access points but also allow greater unmanaged recreational use of those public lands, including off-highway motorized use. Increasing closure of private lands to free public access and shortfalls in funds for public site and facility management will stress the U.S. public recreation supply system. Wilderness areas and special attractions will experience greater congestion at peak times of the year. Unmanaged motorized uses and heavy uses in high-elevation alpine ecosystems (peaks higher than 14,000 feet) can be especially problematic (USDA Forest Service 2007c).

Counties containing at least 10 percent NFS lands are growing in population at a faster rate than most other counties in the United States. These counties have experienced more population growth in recent years than the national average (19 percent as compared to 13 percent nationwide) (Johnson and Stewart 2007). This in-migration is largely amenity-based, meaning that new residents prefer or value particular characteristics and offerings of the landscape setting or context to which they are migrating (Kruger 2003, McGranahan 2008, Raymond et al. 2010). This has implications for forest planning and management. Those preferences of in-migrants could change the local context for forest planning if they reflect social and economic values different from those of current residents (Hernandez and Hidalgo 2007). Issues related to sense of place and communities of place have received much attention from researchers for several decades (Patterson and Williams 2005, Donoghue and Sturtevant 2003, Raymond et al. 2010). Findings generally show that the affected environment includes the sense of place perceived by residents and by visitors, and it also includes the community of place and its members. Moreover, those effects vary such that researchers typically report significant heterogeneity in responses to management actions and resource conditions within a community of research interest related to place or interest (Donoghue and Sturtevant 2003).

Contributions from national forests to jobs and income can affect the local economies of counties within 100 miles of NFS boundaries. Those effects can be greater on those counties that are highly dependent on forest and wildland resources. The National Forest-Dependent Rural Communities Economic Diversification Act of 1990 (7 U.S.C. 6611) was passed to assist rural communities located in or near national forests and economically dependent on forest resources or likely to be economically disadvantaged by Federal or private sector land management practices. During the fall of 2004, it was determined that 590 counties were found eligible for assistance from the act named above (USDA Forest Service 2007b). In addition to the direct benefits derived from goods and services, forest outputs and amenities also have distributional impacts in the form of job and income contributions locally, as well as at broader regional scales (Donoghue and Sturtevant 2003, USDA Forest Service 2011a). Impacts also include effects on a number of social indicators related to lifestyle, community resiliency, and other measures of social health and/or conditions.

Many local communities in dependent counties find their dependency and identity linked to forests or natural landscapes associated with NFS lands (Donoghue and Sturtevant 2003). While some communities benefit from direct extraction of resources (e.g., mining, timber, forage), many also benefit from recreational opportunities and non-local recreational visitors. Some visitors come for brief periods, supporting the tourism industry. Communities rich in natural amenities have always attracted new residents; in recent decades, however, the in-migration of full-time residents (including retirement populations) and proliferation of second homes with seasonal residents has increased. Whether their presence is seasonal or year-round, the economy of some of these towns has become dependent on the presence and activities of these new residents. Affected industries include lodging, food service, recreation, and real estate industries, but social effects on communities are also notable (Garber-Yonts 2004, Kruger et al. 2008). While the presence of NFS lands may have a strong influence in the growth of nearby communities, it also comes with liabilities. Adjacency to NFS lands can expose adjacent communities to natural disturbances, such as insect infestations, wildland fire, disease outbreaks, and drought; manifestations of these disturbances, in the form of wildfires, can threaten health and safety, stress community services, and a number of values-at-risk (Turner et al. 2003).

The ethnic makeup of nearby populations leads to varying interests and recreational needs in recreation on national forests and grasslands. The opportunity explanation of racial/ethnic differences in outdoor recreation participation suggests that minorities are expected to visit outdoor recreation areas in proportion to their presence in the population proximal to the resources. However, Johnson et al. (2007) note that the percentage of visits by African Americans is very low across the NFS, even in the South where African Americans are highly concentrated. In contrast, the percentage of Hispanic visits to national forests in the Southwest is high relative to their population proportion.

Recreational preferences can differ among ethnic groups. For example, research studies in southern California show that Latinos tend to be primarily day-use visitors and generally use the natural resource recreation areas in larger and extended family groups as compared to non-Latinos (Chavez et al. 2008). Surveys show that, compared to

Whites, Latinos place greater value on site development, such as paved parking lots, grouped and large-sized picnic tables, barbecue grills, trash receptacles, water faucets, and flush toilets (Chavez 2009).

The Nation will be more racially and ethnically diverse by mid century, according to projections made by the U.S. Census Bureau (2008b). Minorities, now roughly one-third of the U.S. population, are expected to become the majority in 2042. The non-Hispanic, White population is projected to be only slightly larger in total number in 2050 than in 2008. In fact, this group is projected to account for a shrinking percentage of the nation's population in the 2030s and 2040s and comprise 46 percent of the total population in 2050, down from 66 percent in 2008. Meanwhile, the Hispanic share of the Nation's total population is projected to double, from 15 percent to 30 percent. The African-American population is projected to increase from 14 percent of the population in 2008 to 15 percent in 2050. The Asian share of the Nation's population is expected to rise from 5.1 percent to 9.2 percent. Populations of other races are expected to grow; however, their representative share of the national population will not change significantly (U.S. Census Bureau 2008b). It is important to note that the populations described above are not distributed evenly. The diversity of populations proximate to NFS units varies widely.

An additional demographic trend that continues to affect recreation on Federal lands is the aging of the population. While the baby boom generation is credited with being more active longer, aging of this large segment will result in changes in desired recreational activities (Sperazza and Banerjee 2010). National forests and grasslands, especially those identified in Johnson and Stewart (2007) as amenity destinations, will likely face changing expectations from their visiting public.

Current land management planning procedures include the following requirements with respect to recreation:

- Identify the suitability of lands for recreation opportunities, the recreation preferences of user groups, and recreation opportunities on NFS lands.
- Appraise developed recreational facilities in their area of influence for adequacy to meet present and future demands.
- Examine interactions among recreation opportunities and other multiple uses.
- Coordinate recreation planning to the extent feasible with local and State land use or outdoor recreation plans and recreation opportunities already present and available on other public and private lands, with the aim of reducing duplication in meeting recreation demands.
- Inventory the visual resource and include visual quality objectives in management prescriptions for definitive land areas of the unit.
- Plan and implement off-road vehicle use to protect land and other resources, promote public safety, and minimize conflicts with other uses of NFS lands.

  (Alternative B at § 219.21 in Appendix C of this PEIS)

Three recreation planning and management tools that shape the recreation program include:

- Recreation opportunity spectrum (ROS), http://www.fs.fed.us/eng/ROS-RecCapacity/ROS1986,ch1,2.pdf ;
- Scenery management system, http://library.rawlingsforestry.com/fs/landscape; and
- Recreation facility analysis, http://www.fs.fed.us/recreation.

These tools are used to define existing conditions, describe desired conditions, and monitor change. These tools, along with overarching guidance at the national, Department, and Agency levels, serve as the context by which individual national forests and grasslands engage with their communities. In doing so, the unit's recreation-related and amenity-based assets are considered and integrated with a vision for the future that is sustainable and that the unit is uniquely poised to provide. As the current planning rule procedures related to recreation are quite general, these tools contribute to consistency in recreation planning across NFS units.

The recreation opportunity spectrum has been an effective land management planning tool since 1982. The recreation opportunity spectrum is a framework for identifying, classifying, planning, and managing a range of recreation settings. The setting, activity, and opportunity for obtaining experience are arranged along a spectrum of classes from primitive to urban. In each setting, a range of activities is accommodated. For example, primitive settings accommodate primarily non-motorized uses, such as backpacking and hiking; whereas roaded settings (such as roaded natural) or rural settings accommodate motorized uses, such as driving for scenery or access for hunting. Through this framework, planners compare the relative tradeoffs of how different patterns of settings across the landscape would accommodate (or not accommodate) recreational preferences, opportunities, and impacts (programmatic indirect environmental effects) with other multiple uses.

The scenery management system provides a vocabulary for managing scenery and a systematic approach for determining the relative value and importance of scenery in an NFS unit. The system is used in the context of ecosystem management to inventory and analyze scenery, to assist in establishment of overall resource goals and objectives, to monitor the scenic resource, and to ensure high-quality scenery for future generations.

The recreation facility analysis is a process used to assist NFS units in creating a fiscally sustainable recreation program. The analysis addresses the 1982 planning rule requirements to discuss the supply and adequacy of facilities to meet present and future demands. The analysis includes developing a unit recreation niche statement, which identifies those elements that are valued in a landscape by people to be sustained in the future. A niche statement describes what a forest or grassland has to offer in terms of special places, opportunities, and potential experiences, overlapped with what people desire and expect in terms of outdoor recreation from NFS lands.

A review of recently revised land management plans prepared under the 1982 rule provisions showed that recreation has typically been addressed through goals, objectives, suitability, desired future conditions, standards and guidelines, and monitoring requirements. In the environmental impact statements associated with the land management plans reviewed in the Uncertainty of Describing Effects section of this chapter, recreation was discussed as follows:

- Some plans used ROS/settings to set management direction, such as desired conditions and objectives;
- Some plans used ROS/settings just for inventory and tracking purposes;
- Generally, plans had a balance of settings with activity opportunities to help meet demand;
- Potential user conflicts were usually discussed in the environmental impact statement; and
- Potential adverse effects from potential activities from other resources on recreation were discussed and the potential adverse impacts of potential recreation activities on other resources (e.g., riparian areas) were discussed in the environmental impact statements.

The Forest Service's 2010 Framework for Sustainable Recreation is a new strategy that attempts to unite diverse interests, create and strengthen partnerships, focus scarce resources on mission-driven priorities, connect recreation benefits to communities, provide for changing urban populations, and most importantly, sustain and expand the benefits to America that quality national forest recreation opportunities provide. Some of the goals of sustainable recreation are to provide a diverse range of quality natural and cultural resource-based recreation opportunities in partnership with people and communities and to protect the natural, cultural, and scenic environment for present and future generations to enjoy (USDA Forest Service 2010f).

One area of focus of the 2010 Framework for Sustainable Recreation is to restore and protect recreation settings. Recreation settings that have been affected by declining ecosystem health, wildfire, and inappropriate use would be restored to improve the quality of outdoor experiences. The 2010 Framework for Sustainable Recreation would begin to resolve unmanaged recreation through a planned and properly designed network of roads, trails, and facilities, combined with educated citizen stewardship and partnerships, as well as Forest Service field presence to provide quality recreation experiences while reducing the impacts of visitor use on the landscape.

The Framework for Sustainable Recreation is consistent with the concepts of benefits-based management (BBM), which focuses on the effects of a recreational activity rather than the activity itself (Borrie and Roggenbuck 1995). Benefits include four types: personal, social, economic, and environmental. Examples are: improved physical fitness, reduced stress, spiritual growth (Stein and Anderson 2002), community pride, strengthened bonds with friends and family, reduced health costs, local economic growth, and improved ecosystem health (Stein and Lee 1995). Benefits-based management also

considers the needs of nearby communities and society at large (Borrie and Roggenbuck 1995).

The Framework recognizes that recreation contributes greatly to the physical, mental, and spiritual health of individuals; bonds family and friends; instills pride in their heritage; and provides economic benefits to communities, regions, and the Nation. The Framework also recognizes that physical activity is an integral part of a healthy lifestyle, and outdoor recreation is an important option for engaging in physical activity. The vision in the Framework is "Renewing Body and Spirit, Inspiring Passion for the Land," which emphasizes the importance of providing benefits for the public.

A number of focus areas in the Framework promote BBM concepts. In particular, the focus area around community enhancement encourages units to engage communities in conversations about ways to provide economic and quality-of-life benefits. It also promotes working with communities and other agencies to provide for outdoor recreation demands.

Within the context of the Framework for Sustainable Recreation, recreation planning and collaboration tools will continue to be developed and be used in forest plans. These will incorporate, but evolve beyond, the recreation opportunity spectrum, limits of acceptable change, and benefits-based management.

In recent years, the use of collaboration to work with a wide variety of diverse recreational users has been increasing. There has been innovation in recreation and wilderness management and research, which leads to more tools for managers to use. For example, the national visitor use monitoring (NVUM) system is a standard method to collect use data on a regular basis and gives recreation managers the best current estimate of visitation to NFS lands. It also is used to measure the contribution the Forest Service makes to the health of Americans through outdoor pursuits. It further documents visitor spending and visitation patterns, which show the contribution that recreation makes to the economies of forest-dependent communities and the nation. The NVUM system will continue to be used to collect use data, measure the contribution to the health of Americans through outdoor pursuits, and document visitor spending and visitation patterns. As NVUM collects more information about visits to national forests, trend data will be produced which will assist in unit and broad-scale monitoring.

The importance of recreation at a national scale and across Agency boundaries is evidenced in the President's America's Great Outdoors Initiative. This initiative focuses on the challenges, opportunities, and innovations surrounding modern-day land conservation and the importance of reconnecting Americans to the outdoors. The initiative seeks to bring a more effective approach to land management, encouraging collaboration among Government agencies and private citizens to protect our outdoor legacy, fund programs that protect land, provide assistance to communities, and improve opportunities to get young people outdoors. The President's memorandum on America's Great Outdoors is available at http://www.whitehouse.gov/the-press-office/presidential-memorandum-americas-great-outdoors.

The USDA Strategic Plan FY 2010–2015 (USDA 2010a) identifies key Department priorities and desired outcomes as well as the best means and strategies to achieve them. Goal 1 of the strategic plan is to "assist rural communities to create prosperity so they are self-sustaining, repopulating, and economically thriving." The plan includes an objective to retain and generate jobs through recreation programs.

Agency-specific direction is contained in the USDA Forest Service Strategic Plan (USDA Forest Service 2007d). Goal 4 of the plan is to "sustain and enhance outdoor recreation opportunities." Objectives to meet this goal include improving the quality and availability of outdoor recreation experiences, acquiring access (rights-of-way) to NFS lands and waters, and improving management of off-highway vehicle use. More Agency direction specific to recreation is found in the Forest Service Directives System. Following are but a few objectives of the Agency recreation program from Forest Service Manual (FSM) 2302 (http://www.fs.fed.us/im/directives/fsm/2300/2300_zero_code.rtf:

- To provide non-urbanized outdoor recreation opportunities in natural appearing forest and rangeland settings.
- To protect the long-term public interest by maintaining and enhancing open space options, public accessibility, and cultural, wilderness, visual, and natural resource values.
- To provide outdoor recreation opportunities and activities that:
  - Encourage the study and enjoyment of nature;
  - Highlight the importance of conservation;
  - Provide scenic and visual enjoyment; and
  - Instill appreciation of the nation's history, cultural resources, and traditional values.

The recreation program includes policy (FSM 2303) (also available at http://www.fs.fed.us/im/directives/fsm/2300/2300_zero_code.rtf) to:

- Ensure high-quality experiences through location, design, and maintenance of facilities that afford a reasonably safe and healthful recreation experience and provide access to as many people as possible, including persons with disabilities.
- Plan and develop facilities to complement unconfined, non-facility recreation opportunities. Manage NFS recreation facilities and programs to provide natural resource-based outdoor recreation. Strive for natural settings even when sophisticated facilities are necessitated by local conditions.
- Coordinate, rather than compete, with private, other Federal, State, county, and local entities to provide recreation facilities and programs in forest and rangeland settings, including both harvest and non-consumptive enjoyment of wildlife. Do not provide facilities that the private sector could provide, but rather openly encourage the private sector. Do not duplicate the role of other levels of government to provide urban and local facilities and programs.

The Forest Service Directives System contains additional direction for wilderness management. Forest Service policy requires management of the wilderness resource to ensure its character and values are dominant and enduring. Its management must be consistent over time and between areas to ensure its present and future availability and enjoyment as wilderness. Wilderness must be managed to ensure that human influence does not impede the free play of natural forces or interfere with natural successions in the ecosystems and to ensure that each wilderness offers outstanding opportunities for solitude or a primitive and unconfined type of recreation. Wilderness is managed as one resource rather than a series of separate resources. (See Forest Service Manual at www.fs.fed.us/im/directives/fsm/2300/2320.doc.) Wilderness management is also guided by regulation at 36 CFR part 293.

Forest Service policy requires managers to provide river and similar water recreation opportunities to meet the public needs in ways that are appropriate to the NFS recreation role and are within the capabilities of the resource base; and to protect the free-flowing condition of designated wild and scenic rivers and preserve and enhance the values for which they were established. (See Forest Service Manual 2354 at http://www.fs.fed.us/im/directives/fsm/2300/2350.doc.)

The Forest Service recreation program is in part driven by societal preferences and demands. It is incumbent upon recreation planners to understand the demographics of their stakeholders in order to better understand recreation preferences. In order to provide and maintain an appropriate spectrum of sustainable outdoor recreation opportunities on any particular NFS unit, recreation planners must also stay abreast of demographic trends. As NVUM matures, visitor data will provide insights into trends in visitor demographics.

The types of recreation settings and opportunities available on a unit are dependent on types of landscapes and natural resources present. Supply is constrained by the ecosystem and landscape and in some cases by other resource values. The recreation program will continue to be guided by the strategic plans and Agency policy no matter which alternative is selected. The national program and the social and economic impacts of the program are largely independent of planning regulations and land management plans; however, the discussion of effects will focus on how the rule and land management plans would facilitate carrying out the program.

Range

The Forest Service administers approximately 90 million acres of rangelands. These rangelands are diverse lands: they range from the wet grasslands of Florida to the desert shrub ecosystems of Wyoming, from the high mountain meadows of Utah to the desert floor of California. These diverse ecosystems produce an equally diverse array of tangible and intangible products. Tangible products include forage for grazing and browsing animals, wildlife habitat, water, minerals, energy, recreational opportunities, and even some wood products (see Figures 3, 4, 5). These are important economic goods. Rangelands produce intangible products such as natural beauty and wilderness, satisfying important societal values. These can be as economically important as the more tangible commodities.

Data for the following graph illustrating authorized livestock use trends were taken from the Forest Service grazing statistical summary reports, available at http://www.fs.fed.us/rangelands. (No data are available for 1999.)

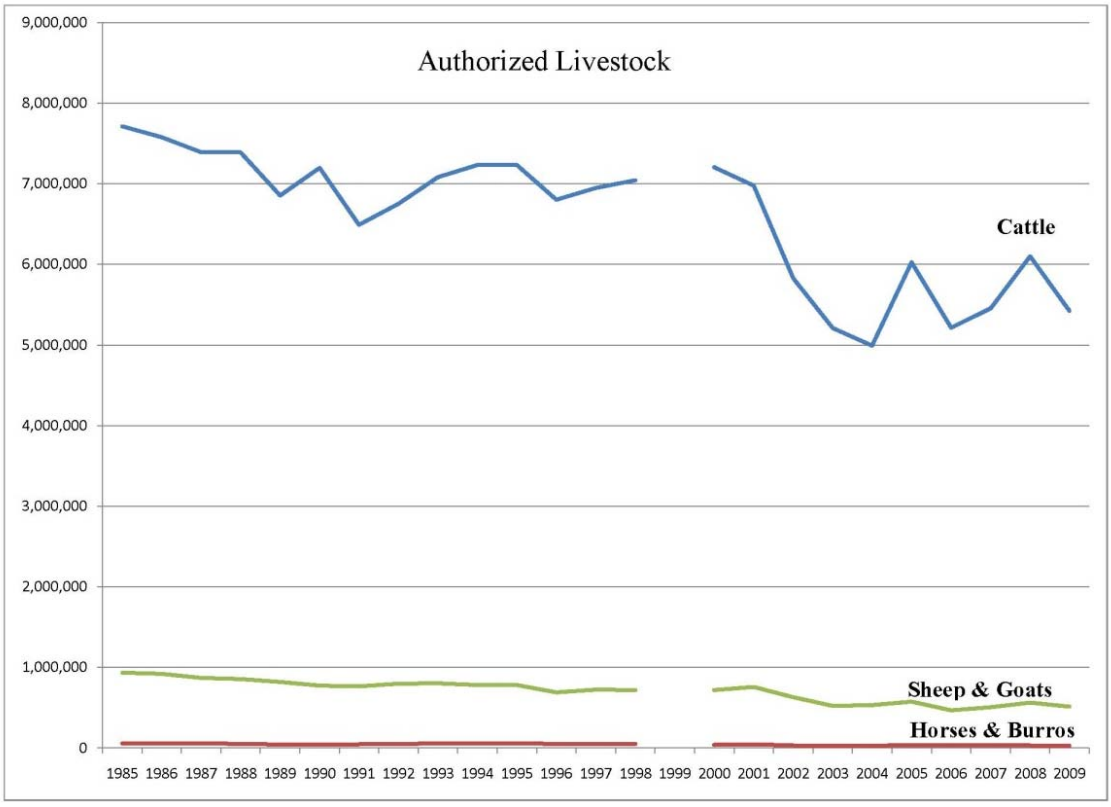

Figure 3. Authorized Livestock Use

Livestock grazing on NFS lands contributes to an estimated 3,695 jobs and labor income totaling $91.9 million (see Appendix M). Management of NFS rangelands for livestock grazing has an influence on private rangelands as well.

The Western States have experienced tremendous population growth over the past 30 years, with many people moving into previously rural areas (Theobald 2001). This exurban development of former rangelands has the potential to significantly affect wildlife and ecosystem processes (Hansen et al. 2002). Any impacts of exurban development in the West tend to be aggravated by the relative positions of public and private lands; that is, private lands are generally at lower elevation, and on more productive soils than public lands (Scott et al. 2001).

Some observers have hypothesized that ranches, by their nature of requiring extensive acreages to produce an agricultural product, act as protected areas for open space and biodiversity (Maestas et al. 2003). Public rangelands contribute key parts of the annual forage requirements for ranches with grazing permits or leases. Unpublished results of a pilot study in the southern Rocky Mountains indicate that private ranches occupy areas that are proximate to public lands. Thus, these lands might not only act to protect open

space and biodiversity, but could also tend to mitigate ecological and social conflicts between public and private lands (Mitchell and Wallace 1998).

National Forest System lands, along with other reserved lands, conserve biodiversity by providing safe havens for species threatened by land-use change and resulting habitat loss. Housing development in the United States can remove and fragment habitat, diminish water quality foster the spread of invasive species, and decrease biodiversity. If long-term trends continue, 17 million housing units will be built within 50 kilometers of protected areas, such as national forests and grasslands, national parks, and wilderness areas, by 2030. One million of these housing units will be within 1 kilometer of protected areas, greatly diminishing their conservation value (Radeloff et al. 2010).

While natural resources, such as rangelands, contribute to economic and social well-being, economic and social conditions contribute to ecosystem sustainability. Healthy rangeland ecosystems depend on supportive social and economic infrastructures. However, competitive markets can sometimes discourage implementation of sustainable practices. Ranchers are expected to internalize the cost of conservation and occasionally choose economic viability over their desire for more sustainable systems (McCollum et al. 2011). Rationale for such choices may be that decisions with future undesirable consequences (a ranchers' desire for sustainable systems) might be preferable to decisions with undesirable consequences today (losing his economic viability). Sustainable rangeland management on NFS lands therefore requires attention to potential economic influences facing grazing permittees.

Bartlett et al. (2002) identified that most ranchers are not motivated primarily by profit from livestock production. Gentner (1999, from Bartlett et al. 2002) found that all types of public lands ranchers ranked quality-of-life factors above profit maximization as reasons for ranching (in Bartlett et al. 2002). In a study of potential outcomes and consequences of a hypothetical proposed grazing permit buyout program, maintaining a family heritage, scenic beauty, providing wildlife habitat, and vocation were all ranked more important by permit holders than profit. This same study indicated that overall, permit holders view developing property for commercial purposes as very unimportant (Steinbach and Thomas 2007). Although research has shown that ranchers would not want to sell their ranches if they lost their grazing privileges on federal lands, such a loss would constitute a major variable in the complex of factors that influence the maintenance of livestock grazing in rural areas (Sulak and Huntsinger 2002).

Resource issues on rangelands often result from multiple causative factors that vary over time and space. Significant knowledge gaps exist and will continue to exist because of the complex nature of the problems. A good framework and a keen understanding of the ecological processes underlying a complex problem do not necessarily translate into on-the-ground solutions, and even when they do, the spatial and/or temporal applicability of such solutions might be limited. Furthermore, these solutions need to be adaptive as the problems continue to evolve over space and time. Adaptive approaches to rangeland management are inherently non-specific with respect to future management direction. That said, it should be stressed that not all problems are complex and in some instances problems could contain both simple and complex elements (Boyd and Svejcar 2009).

There has been scientific debate for years concerning the environmental impacts and sustainability of livestock grazing, particularly in the West (Brown and McDonald 1995, Curtin 2002, Fleischner 1994). Perspectives regarding impacts from livestock grazing on natural resources range from negative through neutral to positive. For example, Brown (1982) states that evidence demonstrates that cover removal resulting from grazing can nearly exterminate a quail population if utilization levels exceed 55 percent by weight in an evenly distributed pattern. However, Kirby and Grosz (1995) reported that rotation-grazed areas had similar density of successful sharp-tailed grouse nests as ungrazed areas. Additionally, Derner et al. (2009) found that using livestock as ecosystem engineers to alter vegetation structure for grassland bird habitat is feasible in terms of application by land managers within the context of current livestock operations, and provides land managers important tools to achieve desired contemporary objectives and outcomes in semiarid rangelands of the western North American Great Plains. While these examples address grassland bird habitat, they represent the range of perspectives associated with most rangeland resources.

The effects analysis for each alternative is focused on the contribution of sustainable uses to support communities rather than whether a specific use is indeed sustainable. The determination of sustainability or compatibility of specific grazing authorizations with the various restoration emphases in the alternatives must be made at a site-specific project level.

Strategic Goal 2 in the USDA Strategic Plan FY 2010–2015 (USDA 2010a) is to "ensure our national forests and private working lands are conserved, restored, and made more resilient to climate change, while enhancing our water resources." The plan includes ranches in its definition of working lands.

Goal 1 of the USDA Forest Service Strategic Plan FY 2007–2012 (USDA Forest Service 2007d) is to restore, sustain, and enhance the Nation's forests and grasslands. Means to achieve Goal 1 include using best management practices when implementing management activities. Goal 2 of the strategic plan is to provide and sustain benefits to the American people. One objective to accomplish this goal is to provide a reliable supply of rangeland products over time that (1) is consistent with achieving desired conditions on NFS lands and (2) helps support ranching in local communities.

Goal 3 of the Forest Service strategic plan is to conserve open space. One of the means stated in the strategic plan to accomplish Goal 3 is to continue NFS grazing permits to maintain associated base properties as sustainable working ranches.

The Forest Service grazing management program manages the diverse rangeland resources to maintain a sustainable supply of forage for livestock and wildlife. The program seeks to maintain open space and habitat connectivity by linking NFS grazing authorizations to privately owned lands managed for agricultural production, and by helping sustain the rural based ranching and farming lifestyle (USDA Forest Service 2010h).

The objectives of the Forest Service range management program include the following:

- To protect basic soil and water resources, provide for ecological diversity, improve or maintain environmental quality, and meet public needs for interrelated resource uses;
- To integrate management of range vegetation with other resource programs to achieve multiple use objectives contained in land management plans;
- To provide for livestock forage, wildlife food and habitat, outdoor recreation, and other resource values dependent on range vegetation; and
- To contribute to the economic and social well-being of people by providing opportunities for economic diversity and by promoting stability for communities that depend on range resources for their livelihoods.

(Forest Service Manual FSM 2202 at http://www.fs.fed.us/im/directives/fsm/2200/2200_zero_code.doc)

Forest Service policy requires managers to identify and inventory range resource values, including riparian, upland, and other critical areas, to determine which areas meet or do not meet plan objectives. Managers are also required by policy to implement and monitor measures to restore and enhance plant diversity and productivity, water quality, and soil stability. Forest Service policy also requires managers to make forage available to qualified livestock operators from lands that are suitable for livestock grazing where consistent with land management plans. Forest Service rangeland management policy is in FSM 2203 (http://www.fs.fed.us/im/directives/fsm/2200/2200_zero_code.doc).

Under current planning procedures, responsible officials identify the suitability of NFS lands for producing forage for grazing animals. Condition and trend is determined for lands identified as suitable for grazing. Estimates are made for present and potential supply of forage for livestock, wild and free-roaming horses and burros, and the capability of these lands to produce suitable food and cover for selected wildlife species. The use of forage by grazing and browsing animals is also estimated. Restoration actions are planned for lands identified as being in less than satisfactory condition (§ 219.20(a)).

Current land management planning procedures include prescriptive analysis requirements for developing rangeland management prescriptions (§ 219.20(b)). Based on these requirements, the responsible official considers alternative range management prescriptions that include:

- Grazing systems and the facilities necessary to implement them;
- Land treatment and vegetation manipulation practices;
- Evaluation of pest problems;
- Possible conflict or beneficial interactions among livestock, wild free-roaming horses and burros and wild animal populations, and methods of regulating these;
- Direction for rehabilitation of ranges in unsatisfactory condition; and
- Comparative cost efficiency of the prescriptions.

Under all alternatives, grazing of NFS lands will continue to be managed through permits, which authorize one or more permittees to graze livestock on a specified area, called an *allotment*. Allotments are administered under an allotment management plan, which specifies objectives, identifies problems involved on the allotment, and defines the actions and monitoring and evaluation responsibilities of the permittee and the Forest Service. Allotment management plans must be consistent with the area forest plan. Allotment management plans are reviewed periodically. Short-term management adjustments are accomplished through annual operating plans whereby numbers of livestock and dates for moving them are established for the year. These annual operating plans provide management flexibility in responding to changes such as seasonal variations in precipitation.

Under all of the alternatives, the goals and objectives of the strategic plans along with Agency policy will continue to guide the range management program. Rangelands will continue to be managed to contribute to the social and economic well being of the local area, region, and Nation.

Timber

The overriding objective of the Forest Service's forest management program is to ensure that the National Forest System is managed in an ecologically sustainable manner. The national forests were originally envisioned as working forests with multiple objectives: to improve and protect the forest, to secure favorable watershed conditions, and to furnish a continuous supply of timber for the use of citizens of the United States (16 U.S.C. 475). Under the MUSYA, the administration of the national forests has expanded to include other purposes, under the principles of multiple use and sustained yield (16 U.S.C. 528-531). Consistent with these principles, forest management objectives include ecosystem restoration and protection, research and product development, fire hazard reduction, and the maintenance of healthy forests. Guided by law, regulation, and Agency policy, Forest Service forest managers use timber sales, as well as other vegetation management techniques, such as prescribed fire, to achieve these objectives. Harvest of timber and other forest products from NFS lands contributed to more than 44,000 full- and part-time jobs with labor income totaling more than $2 billion in 2009 (see Appendix M).

A query of the Forest Service Planning, Appeals, and Litigation System database yielded 1,282 decisions to authorize the sale of green timber (as opposed to salvage) in fiscal years 2006–2010. Of the 1,282 decisions, 142, or 11 percent, were solely for the purpose of producing timber products. The remaining 89 percent included additional purposes such as hazardous fuels reduction, wildlife habitat restoration, and watershed restoration.

National forest timber sales can not only produce timber, but also facilitate fish and wildlife habitat improvement, create roads with attendant recreation access, improve forest productivity, decrease hazardous fuels and associated risks of large, high-intensity wildfires, and improve forest health.

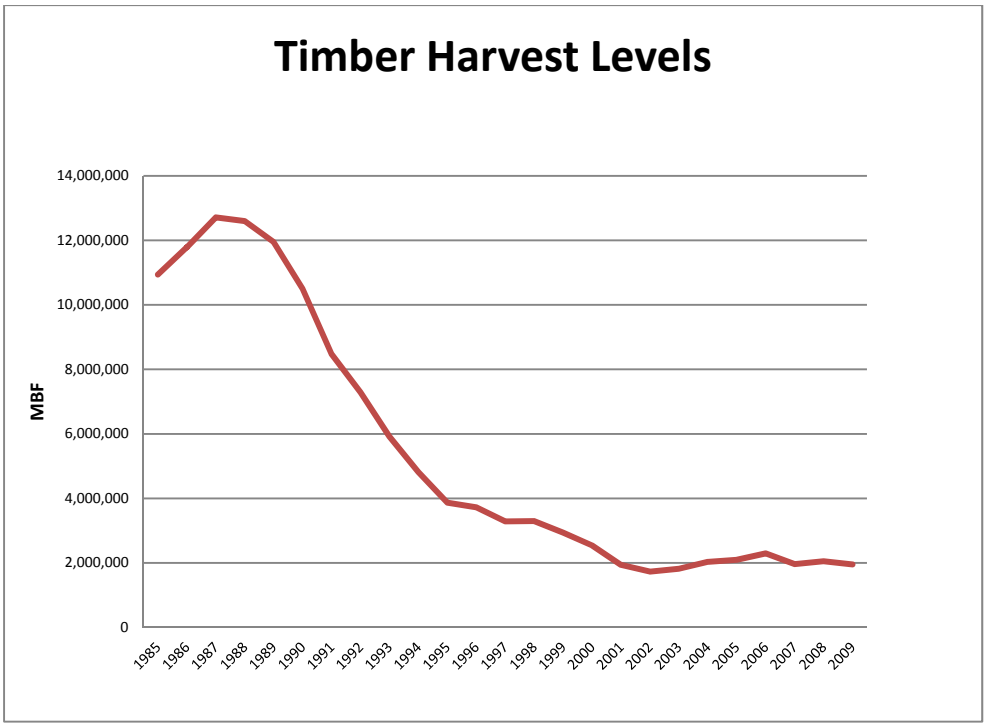

Figure 4. Timber Harvest Levels.

Figure 4 shows the decrease in volume harvested from NFS lands between 1985 and 2009. The data included in Figure 4 come from Forest Service Cut and Sold Reports, which are available at http://www.fs.fed.us/forestmanagement/reports/sold-harvest/index.shtml.

From 1960 to 1985, NFS lands were managed with a substantial emphasis on producing timber to supply U.S. wood consumers and to support communities near national forests. During that time demands for other uses and values of NFS lands have increased dramatically. Since 1982, there has been a shift in planning focus from primarily producing timber to restoring and maintaining healthy ecological conditions and meeting the recreational and amenity preferences of the public. Increasing urbanization has resulted in changes in public values toward expanded recreational opportunities and more set-asides of undisturbed lands.

Over the past two decades, under the 1982 planning rule, the amount of timber sold from the NFS has declined by more than 80 percent and by the first decade of this century provided for less than 5 percent of U.S. softwood timber consumption (MacCleery 2008). Since U.S. wood demand has not diminished, the reduction in timber harvest on national forests has resulted in increased harvests from private lands in the United States (Figure 5). There have also been increases in lumber imports, mostly from Canada (MacCleery 2008).

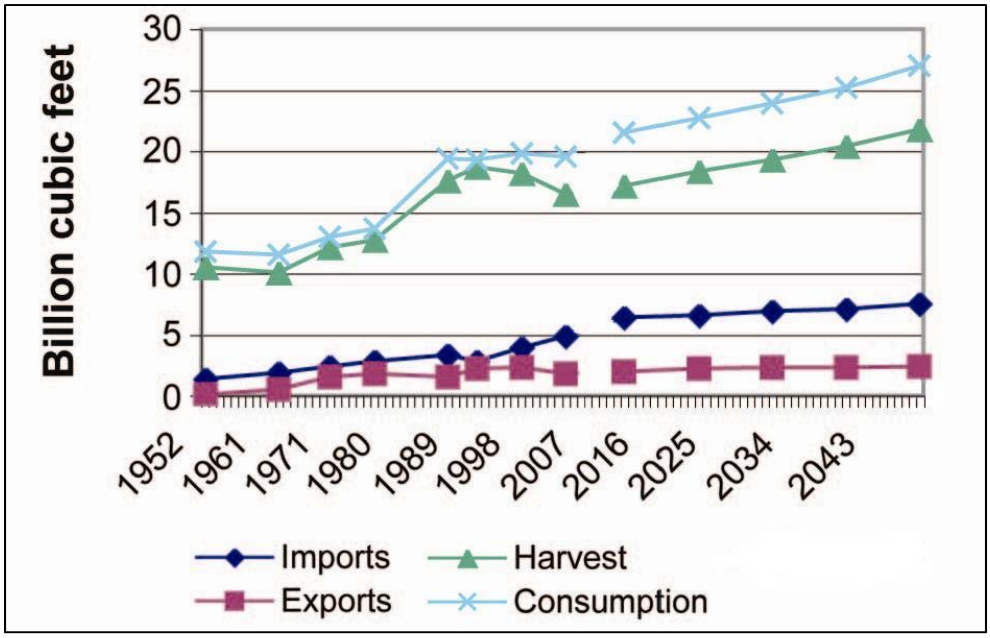

Figure 5. Timber Production and Consumption in the United States (USDA Forest Service 2007c).

Strategic Goal 2 in the USDA Strategic Plan for FY 2010–2015 (USDA 2010a) is to "ensure our national forests and private working lands are conserved, restored, and made more resilient to climate change, while enhancing our water resources." Restoring declining ecosystems and protecting healthy ones will provide ecosystem benefits, which include a sustainable supply of timber products. Goal 2 of the USDA Forest Service Strategic Plan FY 2007–2012 (USDA Forest Service 2007d) is to provide and sustain benefits to the American people. One objective to accomplish this goal is to provide a reliable supply of forest products over time that (1) is consistent with achieving desired conditions on NFS lands and (2) helps maintain or create processing capacity and infrastructure in local communities.

Objectives of the Forest Service forest management program include: (1) providing a continuous supply of NFS timber for the use and necessities of the citizens of the United States, and (2) providing an even flow of NFS timber in order to facilitate the stabilization of communities and opportunities for employment. Agency policy is to use the timber sale program and other forest management activities to enhance timber and other forest resource values and benefits over time. (See Forest Service Manual 2402 at http://www.fs.fed.us/im/directives/fsm/2400/2400_zero_code.doc.)

Development of new plans and plan revisions require identification of lands not suited for timber production. Lands other than those that have been identified as not suited for timber production are assessed to determine the costs and benefits for a range of management intensities for timber production (§ 219.14). Long-term sustained-yield capacity to produce timber and calculation of an "allowable sale quantity" is also determined (§ 219.16). The allowable sale quantity is the volume of timber that may be sold from lands identified as suitable for timber production—usually expressed as an

annual figure. In addition, a base sale schedule is developed that would provide the allowable sale quantity.

In all alternatives, plans would identify lands suitable for various multiple uses, including lands suitable for timber production. Plans would also identify expected timber harvest levels, planned timber sale program, and proportion of probable methods of forest vegetation management practices expected to be used, as required by NFMA (16 U.S.C. 1604(k) and (f)(2)).

Under all alternatives, the Agency will continue to work toward achieving the goals and objectives of the USDA and Forest Service strategic plans and toward achieving the forest management objectives in Agency policy.

Evaluation of the Alternatives

The effects of this issue are analyzed in terms of how each alternative would provide a framework for managing multiple uses, developing or revising plans that consider multiple uses, and monitoring to provide information that allows managers to adapt management of multiple uses to changing conditions. Disclosing the effects of each alternative on the specific multiple uses are not feasible in this PEIS.

Alternative A Effects

Outdoor Recreation

Effects on Plan Content and the Planning Process

Alternative A would specifically require plans to include components to provide for sustainable recreation (§ 219.10(b)(1)(i). Plans would be required to include components to guide the unit's contribution to social and economic sustainability taking into account opportunities and access for sustainable recreation; cultural and historic resources and uses; and other multiple uses that contribute to local, regional, and national economies in a sustainable manner (§§ 219.8(b)). Additionally, Alternative A requires the responsible official to consider recreational values in a landscape-scale context when developing plan components for integrated resource management (§ 219.10(a)(1)), as well as sustainable management of infrastructure, such as recreational facilities and transportation and utility corridors (§ 219.10(a)(3)). Plans would also identify recreational settings and desired conditions for scenic landscape character (§ 219.10(b)(1)(i)). Through consideration of recreational values in a landscape context, NFS units would be expected to provide a mix of sustainable recreational opportunities that complement those of the surrounding area. With the focus on providing sustainable recreation opportunities, a unit would be expected to contribute an element of stability to local economies.

Under Alternative A, people would be provided the opportunity to participate in the assessment process, development of a plan proposal (including the monitoring program), and review of monitoring results (§ 219.4). Alternative A includes prescriptive public engagement requirements not found in the current rule procedures. Specifically, the responsible official would be required to encourage participation by interested individuals and entities at the local, regional, and national levels; reach out to youth, low-income, and

minority populations; encourage participation by local private landowners and interested or affected federally recognized Indian Tribes and Alaska Native Corporations; and encourage State, county, and other local governments to participate as cooperating agencies (§ 219.4(a)). This broad outreach is intended to assure consideration of a full spectrum of recreational uses and values relevant to each NFS unit.

In general, this alternative is designed to facilitate engagement and involvement throughout all phases of land management planning, thereby improving capacity to consider and incorporate values and concerns for all economic sectors and social segments, including amenity-driven demographic shifts associated with local or rural communities affected by plan decisions in dependent counties. Alternative A is also intended to facilitate assimilation of new information about local or rural (as well as national) concerns and values through adaptive management. This alternative is more prescriptive about considering and facilitating restoration of damaged resources as well as improving resource capacity to withstand environmental risks and stressors (i.e., resiliency), thereby providing greater capacity for sustaining local or rural economic opportunities to benefit from forest resources and ecosystem services, including recreation/tourism and water supply/watershed health.

Assessments would include identification of the distinctive roles and contributions of the unit within the context of the broader landscape in providing multiple uses. Additionally, the responsible official would consider relevant information in any State comprehensive outdoor recreation plans (§ 219.6(b)(2)). Therefore, the responsible official would be cognizant of the recreational opportunities provided by the unit and how those opportunities integrate with recreational opportunities within the surrounding area. Consequently, proposals for new plans and for plan revisions would be expected to reflect an integrated mix of recreational opportunities complementing those of the local area and within the capability of the unit.

Under Alternative A, plans would provide for the protection of wilderness areas as well as the protection of recommended wilderness areas, and to protect the ecological and social values and characteristics for which they might be added to the National Wilderness System. Plans would also provide for protection of wild and scenic rivers as well as the protection of eligible wild and scenic rivers to protect the values for which they might be added to the national system of wild and scenic rivers until suitability is determined (§§ 219.7(c) and 219.10(b)). Management of wilderness areas and wild and scenic rivers is largely guided by statute and Agency policy described under the Affected Environment section and, therefore, would not change as a result of Alternative A.

Under this alternative, all plan monitoring programs would include specific recreation-related monitoring questions on status of visitor use and progress toward meeting recreational objectives and fulfilling the unit's distinctive roles and contributions to social and economic conditions of the local area, region, and Nation (§ 219.12(a)(5)). Alternative A would bring more consistency to plan monitoring programs across the NFS than under Alternative B and increase the probability of plans being responsive to changes in recreation values and use trends.

Alternative A defines sustainable recreation as the set of recreational opportunities, uses, and access that, individually and combined, are ecologically, economically, and socially sustainable, allowing the responsible official to offer recreation opportunities now and into the future. Recreational opportunities can include non-motorized, motorized, developed, and dispersed recreation on land, water, and air. This definition ensures the concept of balancing ecological, economic, and social aspects of sustainability found in the sustainable recreation framework endures.

To meet the requirements in Alternative A for sustainable recreation, it is expected that plans would consistently include components based on the sustainable recreation framework described in the Affected Environment section, which provides a comprehensive planning approach for recreation. As plans are implemented over time, the quality of the outdoor recreation experience would be improved. Restoring and adapting recreation settings that have been affected by declining ecosystem health, wildfire, and inappropriate use would not only benefit recreation users and businesses associated with recreation use, but it would also contribute to the other multiple uses and ecosystem services that provide benefits to communities.

Range

Effects on Plan Content and the Planning Process

Under Alternative A, in assessments for plan development or revision, the responsible official would identify the distinctive roles and contributions of the unit within the context of the broader landscape, considering the roles of the unit in providing multiple uses (§ 219.6(b)(3)). Where currently authorized, the role and contribution of providing forage for livestock grazing would be identified. The responsible official would also identify and evaluate information needed to understand and assess existing and potential future conditions and stressors in order to inform and develop required plan components, including plan components for sustainability (§ 219.6(b)(1)). This would be expected to bring to light any allotments in poor watershed condition or downward trend.

In developing a proposed new plan or proposed plan revision, the responsible official would consider conditions, trends, and stressors with respect to the requirements for plan components (§ 219.7(c)(2)(iii)). Plans under Alternative A would include components to maintain or restore the structure, composition, function, and connectivity of healthy and resilient terrestrial and aquatic ecosystems and watersheds in the plan area. These would take into account potential system drivers, stressors, and disturbance regimes; how they might affect ecosystem and watershed health and resilience; and the ability of those systems on the unit to adapt to change (§ 219.8(a)).

Plans under this alternative would include a monitoring program that sets out the unit monitoring questions and associated indicators to inform the management of resources on the unit, including testing relevant assumptions, tracking relevant changes, and measuring management effectiveness and progress toward achieving or maintaining desired conditions or objectives. Monitoring related to rangeland management would include questions to address the status of select watershed and ecological conditions; progress toward fulfilling the unit's distinctive roles and contributions to ecological, social, and

economic conditions of the local area, region, and Nation; and the effects of management systems to determine that they do not substantially and permanently impair the productivity of the land (§ 219.12(a)(5)). The responsible official would conduct a biennial evaluation of the monitoring information (§ 219.12(d)). Plan monitoring programs under Alternative A would, over time, evaluate the effectiveness of management strategies for restoration and protection of healthy rangelands.

As plans are revised and grazing authorizations are made consistent with revised plans (§ 219.15), rangelands would be expected to be managed to maintain or restore healthy conditions. With the alternative's focus on providing for sustainable uses, a unit would be expected to contribute an element of stability to local economies. Where restoration is needed and livestock grazing is identified as a stressor, allotment management plans would be expected to be modified (e.g., reductions in numbers, changes in season of use, or additional improvements). However, such modifications and their attendant effects would be analyzed on a site-specific basis for each allotment.

Timber

Effects on Plan Content and the Planning Process

With a few exceptions, the substantive and procedural direction in Alternative A is consistent with the direction in Alternative B with respect to the forest management program and timber. The NFMA requirements that are related to identifying lands not suited for timber production and that constrain timber harvest are combined in one section in Alternative A (§ 219.11). Other relevant sections of Alternative B and Alternative A are comparable as follows:

- Alternative A would require identification and consideration of the distinctive roles and contributions of the unit within the context of the broader landscape, considering the roles of the unit in providing multiple uses, including ecosystem services (§ 219.6(b)(3)). The responsible official would also be required to consider and evaluate existing and possible future conditions and trends of the plan area, and assess the sustainability of social, economic, and ecological systems within the unit, in the context of the broader landscape (§ 219.5(a)(1)), while Alternative A rule would require identification of areas not suited for timber production (§ 219.11(a)).
- Alternative A would require plans to limit the quantity of timber that can be removed annually in perpetuity on a sustained-yield basis (§ 219.11(d)(4)), the planned timber sale program, and probable methods for forest vegetation management practices expected to be used (§ 219.7(e)(1)(iv)).

The emphasis of Alternative A on ecosystem sustainability would result in plans that include components to maintain or restore the structure, composition, function, and connectivity of healthy and resilient terrestrial and aquatic ecosystems and watersheds in the plan area (§ 219.8). These plan components are consistent with the trend in forest management objectives, which have evolved to include ecosystem restoration and protection, hazardous fuels reduction, and the maintenance of healthy forests.

Consequently, trends in the NFS timber program would be expected to continue as described in the Affected Environment section.

Modified Alternative A Effects

The effects of Modified Alternative A are the same as Alternative A. There were some technical corrections made to make Modified Alternative A consistent with NFMA, the Wilderness Act, and the Wild and Scenic Rivers Act. The technical corrections reflect the intent of Alternative A and therefore do not change the effects analysis. Additionally, Modified Alternative A adds clarifying language stating that suitability identifications may be made after consideration of historic uses and of issues that have arisen in the planning process (§ 219.7(e)(1)(5)).

Alternative B Effects

Outdoor Recreation

Effects on Plan Content and the Planning Process

Under Alternative B, land management plans would continue to reflect the current recreation planning and monitoring procedures (§ 219.21) and tools described in the Affected Environment section. Since there would be no requirements for addressing recreation in assessments, planning would vary widely from unit to unit in analysis of distinctive roles and contributions to recreation opportunities within the context of the broader landscape. Consistent monitoring across NFS would be expected because use of the national visitor use monitoring system (described in the Affected Environment section) would be expected to continue, thereby assuring consistent recreation monitoring across NFS units.

Planning under Alternative B procedures would continue to include the need to identify recreation opportunities on NFS lands and their ability to meet present and future recreation demands. However, with less emphasis placed on facilitation of engagement and involvement during all phases of planning, this alternative is expected to result in less capacity than Alternative A and Modified Alternative A for considering and incorporating the broad range of values affecting economic sectors and social segments within rural and/or amenity-dependent communities.

Recreation programs and trends discussed in the Affected Environment section would continue. However, sustainable recreation is not explicitly defined in this rule. As plans are implemented, application of sustainable recreation concepts would be driven by Agency guidance, such as the sustainable recreation framework, rather than by regulation.

Range

Effects on Plan Content and the Planning Process

Planning under the Alternative B procedures would continue to include identifying the suitability of NFS lands for producing forage for grazing animals. Land management

plans and the rangeland management program would continue to reflect the current procedures described in the Affected Environment section.

Trends in authorized numbers of livestock described in the Affected Environment section would be expected to continue.

Timber

Effects on Plan Content and the Planning Process

Alternative B requires an analysis of demand and supply conditions for resource commodities and services, production potentials, and use and development opportunities. This includes the current level of goods and services provided by the unit and the expected levels if current management continues (§ 219.12(e)).

Alternative B procedures require identification of lands suitable and not suitable for timber production (§ 219.14(a)). Alternative B requires calculation of the long-term sustained-yield capacity for timber production, identification of an allowable sale quantity of timber, and a sale schedule that provides that amount (§ 219.16).

Land management plans and the forest management program under Alternative B would continue to reflect the current procedures described in the Affected Environment section. The trends in timber harvest levels would be expected to continue.

Alternative C Effects

Outdoor Recreation

Effects on Plan Content and the Planning Process

Under Alternative C, plan components would include provisions for sustainable recreation, considering opportunities and access for a range of uses. Plans would identify recreational settings and desired conditions for scenic landscape character (§ 219.10). Since there would be no requirements for addressing recreation in assessments, planning would vary widely from unit to unit in analysis of distinctive roles and contributions to recreation opportunities within the context of the broader landscape. Consistent monitoring across NFS would be expected because use of the national visitor use monitoring system (described in the Affected Environment section) would be expected to continue, thereby assuring consistent recreation monitoring across NFS units.

Planning under this alternative would be collaborative and participatory, although the methods and timing of public involvement opportunities would be left to the responsible official's discretion (§ 219.4). The collaborative process would help ensure identification and consideration of recreation-related issues and development of plan components to address those issues in the plan. Overall however, the Forest Service's capacity for efficient consideration, assimilation, and adaptation to new values and concerns from economic sectors and social conditions associated with rural amenity-dependent communities is expected to be lower under Alternative C, compared to Alternatives A,

Modified A, D, and E, because of the elimination of most prescriptive requirements designed to enable planning efficiency.

The recreation program tools and direction described in the Affected Environment section would continue to guide recreation management on NFS lands. Therefore, the mix of recreation opportunities provided on each NFS unit would be expected to reflect public recreation uses and values. Absent the more detailed requirements in any of the other alternatives, however, there would be less assurance of consistency in recreation planning across NFS units and less assurance that all public recreation needs and values would be considered.

Range

Effects on Plan Content and the Planning Process

As in Alternative A and Modified Alternative A, this alternative would allow identification of areas suitable for various multiple uses (§ 219.7(d)(1)(v)). Where livestock grazing is currently authorized, lands would be expected to be identified as suitable for this use. Similarly, plans would include components to guide the unit's contribution to social and economic conditions relevant to the area influenced by the plan and the distinctive roles and contributions of the unit within the broader landscape (§ 219.8(b)). Plans would acknowledge the unit's contribution to providing forage for livestock and include relevant components to guide authorization and management of this use. Beyond these two commonalities, there are no specific requirements related to rangeland management in this alternative. It is expected that some practices related to range management requirements in current procedures would be followed simply because they would inform the development of desired conditions, objectives, standards, and guidelines. For example, some type of assessment of range condition and trend would inform a determination about the need for change in any of these plan components. However, there would be a low probability of consistency in assessment of the rangeland resource, plan components to guide its management, or monitoring across NFS units.

Trends in authorized numbers of livestock described in the Affected Environment section would be expected to continue.

Timber

Effects on Plan Content and the Planning Process

Without additional prescriptive requirements, timber direction in plans under Alternative C would not be expected to exceed the minimum NFMA requirements for timber production that are common to all alternatives. Plans would identify lands suitable for various multiple uses, including suitability for timber production. Plans would also identify expected timber harvest levels, planned timber sale program, and proportion of probable methods of forest vegetation management practices expected to be used, as required by NFMA (16 U.S.C. 1604(k) and (f)(2)).

The trend in public and Agency values toward restoring and maintaining healthy ecological conditions would be expected to supplant the absence of prescriptive direction

in this alternative. Consequently, plans would tend to focus more on outcomes than on outputs. That is, more effort would be spent on defining desired ecological conditions and probable methods to achieve them than on maximizing the economic benefits of commodity production. Even with this shift in focus, timber harvest is a valuable tool to achieve many resource benefits. As discussed in the Affected Environment section, forest management objectives include ecosystem restoration and protection, research and product development, fire hazard reduction, and the maintenance of healthy forests. Maintaining healthy forests contributes to wildlife habitat, watershed condition, and recreational values.

The current forest management program and attendant timber harvest level would not be expected to vary from that which is described in the Affected Environment section.

Alternative D Effects

Outdoor Recreation

Effects on Plan Content and the Planning Process

Alternative D is similar to Alternative A except that plans would include specific standards and guidelines for watershed and riparian protection and prescriptive sustainability and diversity requirements (§ 219.5). Plans would restrict management activities within riparian areas to be primarily for restoration (§ 219.8). Plans would require that other activities in riparian areas be designed to minimize impacts on their ecological function (§ 219.8(a)). Recreation would be addressed in assessments, throughout the plan content and in monitoring the same as it would in Alternative A.

Similar to Alternative A, collaboration would enhance current capacity for consideration of a broad spectrum of recreational values and an integrated mix of sustainable recreation opportunities relevant to each NFS unit. More explicit requirements about vulnerability assessments, conservation area refinements, consideration of watershed sustainability and health guidelines in plan components, and consideration of species viability within plan components and assessments under Alternative D have the potential to increase opportunities for sustaining local economic opportunities that rely on the resiliency of forest ecosystems and corresponding amenities. However, the extent to which Alternative D affects local or rural communities could be highly unit-specific.

Some existing recreation facilities such as trails, trailheads, and campgrounds located in riparian areas might not be compatible with these specific requirements. To be consistent with a land management plan under this alternative, future recreation facilities would be expected to either be located outside of riparian areas or include mitigation features to protect riparian functions. With an emphasis on reducing road densities, motorized access could be reduced below current levels or those that could be expected under any of the other alternatives. The combined restrictions on activities in riparian areas and emphasis on reducing road densities could shift the mix of recreation opportunities away from developed and motorized in some areas to more undeveloped and non-motorized forms of recreation. However, such resource conflicts can only be identified at the unit planning level.

Range

Effects on Plan Content and the Planning Process

Plan components and the effects thereof under Alternative D would be similar to those of Alternative A except that plans under Alternative D would contain additional specific standards and guidelines for protection, maintenance, and restoration of key watersheds and riparian conservation areas (§ 219.8). Plans would limit management activities within riparian conservation areas to those that are primarily for restoration (§ 219.8(a)). On NFS lands, estimates indicate that riparian conditions are good in more than 90 percent of Alaska, 70 percent of the East, and 60 percent of the South; in the West the range is from more than 50 percent in more humid sections to less than 30 percent in semiarid and arid areas (Sedell et al. 2000).

Except where grazing was used as a tool for restoration,, allotment management plans would be expected to be modified (e.g., numbers, season of use, or additional investments in livestock water sources). This alternative would require significant investment in exclosure of riparian areas if grazing were to continue on NFS lands. The effects on resources of this alternative are described under the Watershed Conditions and Species Diversity sections of this document.

Timber

Effects on Plan Content and the Planning Process

Alternative D is similar to Alternative A except that plans would include specific standards and guidelines for watershed and riparian protection and prescriptive sustainability and diversity requirements (§ 219.8). Plans would restrict management activities within riparian areas to be primarily for restoration (§ 219.8(a)).

Under this alternative, plan components would not be expected to change the program level from that described in the Affected Environment section, although there could be a trend toward harvest of smaller diameter material. Plan components would be expected to focus unit forest management program objectives toward restoration and maintenance of riparian areas, watersheds, and habitat connectivity. Examples might include harvesting coniferous timber from a riparian area to restore native hardwoods, harvesting small-diameter timber from overly dense stands due to fire exclusion to reduce hazardous fuels, and harvesting loblolly pine stands in longleaf pine ecosystems to restore longleaf pine habitats for red-cockaded woodpecker.

Alternative E Effects

Outdoor Recreation

Effects on Plan Content and the Planning Process

Alternative E is similar to Alternative A except that it would require more formal public participation and more resources and planning for collaboration (§ 219.4(a)). One of the principles of the Agency's Framework for Sustainable Recreation is that community

engagement is essential for creating a sustainable recreation program (USDA Forest Service 2010f). Since the Forest Service recognizes the value of public engagement, the assumption is that under Alternative E, more formal public participation could result in participation of a broad spectrum of recreation users, and decisions could, therefore, reflect a fuller range of opportunities. Alternative E would also require specific monitoring and evaluation of recreation-related conditions and trends and user satisfaction (§ 219.12(a)). Plans under Alternative E would include signal points built into their monitoring programs that would prompt responsible officials to react to monitoring data in a timely manner. This would be expected to allow the responsible official to respond to recreation-related trends and conditions more quickly through plan amendments. More specific monitoring requirements would afford greater assurance than Alternative A that recreation-related monitoring would be conducted and that appropriate plan amendments would be made in a timely manner.

Similar to collaboration under Alternative A, collaboration under this alternative would be expected to enhance the Agency's current capacity for consideration of a broad spectrum of recreational values and an integrated mix of sustainable recreation opportunities relevant to each NFS unit. Under this alternative, there could be increased opportunities to recognize economic and social values and concerns from multiple sectors and segments associated with rural communities under Alternative E where additional requirements for developing public participation plans could provide greater assurances about coverage of diverse interests. However, the extent to which Alternative E affects local or rural communities could be highly unit-specific.

Range

Effects on Plan Content and the Planning Process

The effects of Alternative E would largely reflect those of Alternative A. However, under the additional requirements of Alternative E, responsible officials would monitor status and trends of vegetation diversity, including vegetation composition, structure, abundance, distribution, and successional processes (§ 219.12). Monitoring would indicate how well management actions are maintaining or making progress toward desired conditions for the key characteristics of vegetation in the plan area. Each monitoring question and its associated indicator would be accompanied by a description of one or more signal points, which would be used by the responsible official to determine the need to take action(s) appropriate to the situation. Such actions might include changing plan component(s), collecting additional information, or requesting new research (§ 219.12(a)).

The additional elements prescribed under this alternative would be expected to allow the responsible official to respond to changes in rangeland ecosystem-related trends and conditions more rapidly than under Alternative A. These more specific monitoring requirements afford greater assurance than Alternative A that rangeland monitoring would be conducted and that appropriate plan amendments would be made in a timely manner.

Effects on Resources Expressed as General Outcomes Over Time

The effects of Alternative E would largely reflect those of Alternative A.

Timber

This alternative consists of the same requirements that are in Alternative A, with additional requirements for monitoring and collaboration. These additional requirements would not be expected to result in any different effects on the planning process or to resources expressed as general outcomes over time from those described for timber under Alternative A.

EFFICIENCY AND EFFECTIVENESS

Affected Environment

The effects of the alternatives have been evaluated in the context of procedural or programmatic planning capacity to efficiently and effectively meet the objectives of the Multiple-Use Sustained-Yield Act of 1960 (MUSYA) and the National Forest Management Act of 1976 (NFMA) (i.e., to manage for multiple use and sustained yield of the goods and services in perpetuity giving due consideration to the relative values of resources).

The national forests and grasslands contain abundant natural resources and opportunities that help meet the demands and needs of the American people. The benefits provided by National Forest System (NFS) lands have evolved over time in response to many social, economic, and environmental factors. The most recent strategic plan for the Forest Service (USDA Forest Service 2007a) refers to a number of outputs and services that generate benefits for rural and urban populations including rangeland products (forage) associated with grazing permits; wood fiber to help meet demand for forest products; woody biomass (as a source of alternative energy) from fuel reductions and restoration treatments; access to energy-minerals; open space and undeveloped forest land to help protect and conserve wildlife, recreation opportunities, and scenic beauty; high-quality outdoor recreational experiences; as well as other market and non-market ecosystem services. Forest outputs and amenities also have distributional impacts in the form of job and income contributions locally, as well as at broader regional scales. Impacts also include effects on a number of social indicators related to lifestyle, community resiliency, and other measures of social health and/or conditions.

Contributions to jobs and income from National Forests can affect the local economies of the 2,545 counties located within 100 miles of NFS boundaries. Effects may be more substantial on 590 of those counties that are determined to be highly dependent on forest and wildland resources (i.e., wildland dependent counties) (USDA Forest Service 2010f). Many local communities in dependent counties find their dependency and identity linked to forest or natural landscapes associated with National Forest System lands. While some communities benefit from direct extraction of resources (e.g., mining, timber, forage), many also benefit from recreational opportunities as well as non-local recreational visitors.

Populations and economic activity shift in response to changes in preferences for or changes in local amenities which range from education, health and safety, to natural resource and landscape attributes (e.g., recreational opportunities; market and non-market benefits derived from ecosystem services) provided by NFS lands. The economic forces tied to local amenities have transformed many areas surrounding NFS lands and help explain population and demographic shifts as well as economic performance and 'health' of many communities within regions such as the mountain West and Pacific Northwest (see for example Garber-Yonts 2004). While the presence of NFS lands may have a strong influence in the growth of nearby communities, it also comes with liabilities. Many adjacent communities have also become susceptible to natural disturbances such as insect infestations, disease outbreaks, and drought. Manifestations of these disturbances in the form of wildfires, can threaten health and safety, and a number of values-at-risk. United States population growth and expanding urban centers have created greater demand for goods, services, and amenities from the nation's private and public forests and grasslands. Current population growth trends also show a steady loss of open spaces to developed uses.

There are a number of challenges to developing and maintaining management plans for NFS lands that are capable of (i) sustaining multiple uses, (ii) maintaining productivity, and (iii) meeting public demands that reflect broad and expanding resource values. Challenges include consideration of evolving values and value tradeoffs that are driven by conditions both within and beyond the boundaries of NFS lands. The procedural and programmatic requirements established under this action will affect the degree to which these and other future challenges can be addressed while meeting the goals of the National Forest Management Act and the Multiple-Use Sustained-Yield Act.

Methodology and Assumptions

The scope of this analysis is limited to the activities related to development, revision, and amendment (i.e., maintenance) of land management plans (i.e., programmatic or procedural activities) for management units (e.g., national forests, grasslands, and prairies) within the NFS. As such, Agency or private costs and benefits associated with on-the-ground or site-specific activities and projects resulting from implementation of individual plans are not characterized or projected. The efficiency and effectiveness analysis is taken from the Regulatory Impact/Cost-Benefit Analysis prepared for the planning rule (USDA Forest Service 2011a).

Differences in Agency planning costs across alternatives are estimated when possible, but benefits are discussed qualitatively in the context of potential changes in procedural or programmatic efficiency. The key activities for which costs are analyzed include:

- Assessments (e.g., activities conducted to establish what changes to a plan may be needed, prior to initiating plan revisions or amendments);
- Collaboration (e.g., collaboration and public engagement activities in addition to requirements for public involvement, including public scoping, comment consideration and comment response set out in NEPA and its implementing regulations and Forest Service NEPA procedures);

- Development and analysis of plan revision and amendment decisions (i.e., developing alternatives; analyzing and comparing the effects of alternatives; and finalizing and documenting approvals of revisions and amendments);
- Science support (i.e., documentation that assures consideration of the best available scientific information);
- Monitoring (limited to those monitoring activities that support planning); and
- Resolution of disputes about proposed plans or amendments, through an objection process, or about approved plans or amendments, through an administrative appeal process (excluding costs for litigation).

The primary sources of data used to help estimate Agency costs include recent cost-benefit analyses, business evaluations, and budget justifications for planning rules between 2000 and 2008, as well as recent historical data (1996–2009) regarding regional and unit-level budget allocations and paid expenditures for planning and monitoring activities related to planning. Agency costs are initially estimated for the current procedures (i.e., Alternative B) and then used as a baseline from which adjustments are made, based on explicit differences in planning procedures, to estimate costs for Alternative A, and Modified Alternative A, and the other alternatives. Annual costs are estimated separately for years during which units (with regional support) are engaged in plan revision and years engaged in plan maintenance/amendment and then aggregated to estimate total planning costs.

Efficiency is a function of the time and resources used (i.e., the costs) to complete and maintain plans and the degree to which those plans are capable of providing direction for resource monitoring, management, and use/access that meets MUSYA and NFMA objectives(i.e., sustains multiple uses in perpetuity and maintains long-term health and productivity of the land for the benefit of human communities and natural resources, giving due consideration to relative values of resources). Over a 15-year planning cycle, it is assumed that management units would be engaged in plan revision for 3 to 4 years under Alternative A and Modified Alternative A and 5 years under Alternative B. Plan maintenance or amendment would be occurring for the remaining years between revision cycles (i.e., 'plan maintenance' is assumed to be occurring during all times when plan revision is not occurring). It is also assumed that approximately 120 management units would at least initiate plan revision over the next 15 years (i.e., 2012 through 2026). Total costs are assumed to cover activities directly related to planning and planning-related monitoring at the unit and regional office levels, as well as indirect or overhead (i.e., add-on or cost pools) activities to support planning activities. Costs do not include project-level activities (project and alternative development, NEPA analysis, etc.). Total costs (in 2009 dollars) are estimated for a 15-year planning cycle.

Agency planning and monitoring budgets have fluctuated over the years. In 2000, Congress approved an administration proposal to re-align funds under a primary purpose principle, resulting in a substantial shift of funds into planning and monitoring. Prior to this shift, planning and monitoring were partly conducted with funds contributed from other budget line items. Shortly afterward, funds were again shifted—this time from

planning to monitoring to reflect the relative emphasis on these two activities in new planning rules. Figure 6 illustrates these budget trends since 1995.

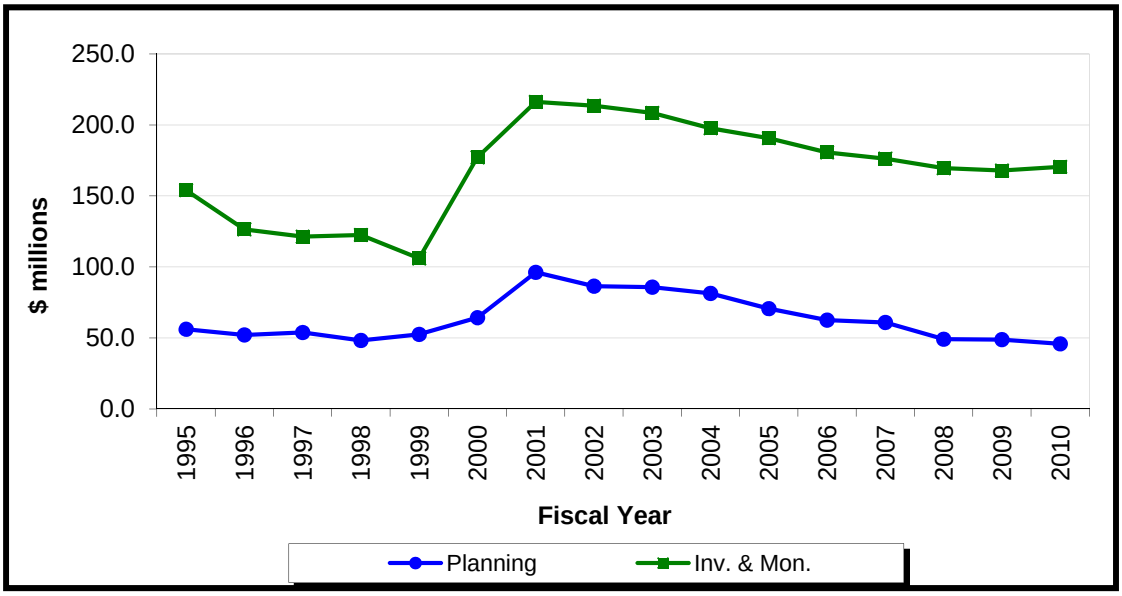

Figure 6. Planning, Inventory, and Monitoring Budget Trends.

The consequence of planning cost has an inversely proportional effect on the number of plans that could be revised at one time and possibly the length of time to complete revision. For example, a 25 percent increase in cost might mean 25 percent fewer plans would be revised over a given time period.

Given that historical Forest Service budget and expenditure data, as well as past planning rule cost information, are not capable of providing a complete characterization of the relative differences in activity-specific costs between current rule procedures and the alternatives, final adjustments or refinements were made to revision and maintenance year costs, by key activity, based on additional input and personal communications with Forest Service planning staff and rule-writing team. The planning staff and rule-writing team have all been involved in various aspects of plan amendment and revision. Even with these refinements, it should be acknowledged that substantial uncertainty remains within cost estimates and projected differences in costs across alternatives. Additional details about cost assumptions and estimations for key activity categories are provided in Appendix K.

Agency Cost Effects

As indicated in Tables 5 and 6 the annual cost to the Agency for all planning-related activities under Modified Alternative A ($97.7 million per year) is estimated to be $4.8 million lower compared to Alternative A, and $6.3 million lower compared to current rule procedures ($104 million per year). Alternative A is estimated to be $1.5 million per year lower compared to current rule procedures. Estimated costs for Alternatives A and Modified Alternative A are within the historic range of aggregate planning, inventory, and monitoring annual budgets (1995-2010) (Fig. 6). Given the relative small change in estimated costs, combined with the uncertainty associated with costing assumptions,

estimated annual planning costs for Modified Alternative A are not projected to be substantially different from Alternatives A and B. It is anticipated, however, that units will have greater capacity to maintain the currency, reliability, and legitimacy of plans to meet the objectives of MUSYA and NFMA, thereby improving the quality of plans and the efficiency of the planning process under Alternatives A and Modified A.

Under Alternative A, as well as Alternatives D and E, costs are projected to be redirected toward collaboration, assessment, and monitoring activities and away from analysis/decision tasks compared Alternative B (see Tables 5 and 6). Under Modified Alternative A, there is relatively less effort redirected toward the assessments and there are some small reductions in effort directed toward science support and monitoring compared to Alternative A. Slightly more effort is re-directed back to activities associated with development and analysis of proposed plans or amendments (i.e., analysis and decision phase) under Modified Alternative A compared to Alternative A.

Costs are also redirected more toward non-revision periods (i.e., plan maintenance) under Alternatives A and Modified A, as well as Alternatives D and E (compared to Alternative B), due in part to the reduced number of years anticipated to be needed for plan revisions. Reductions in time needed to complete plans and plan revisions are projected to occur under Alternatives A and Modified A as an aggregate result adjustments to the planning process as a whole, as clarified in the following section. Potential for broader support and resolution of issues as a consequence of collaboration throughout the process is expected to contribute to, but not be solely responsible for reductions in time needed for revisions.

Litigation costs are not included in annual Agency cost estimates. However, the planning framework under Alternatives A and Modified A, including (i) greater emphasis on public participation and collaboration, (ii) adoption of a pre-decisional objection process, and (iii) clearly representing the Agency's responsibilities, is expected to result in more efficient resolution of issues (including issues related to viability) during the planning process, prior to final decisions.. There is no expectation of unanimous support for any given proposed plan revision under any of the alternatives.

Table 6. Estimated Average Annual Agency Costs (For All Units in $1,000 Per Year)

Planning Activity	Modified Alternative A	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Assessment	$9,517	$12,627	$8,744	$6,558	$14,521	$12,627
Collaboration	$10,608	$10,608	$1,213	$1,213	$10,608	$14,321
Analysis/Decisions	$22,630	$22,080	$49,350	$33,120	$24,288	$22,080
Science Support	$1,906	$2,160	$1,563	$1,563	$2,160	$2,160
Resolutions	$920	$920	$2,150	$2,150	$920	$920
Plan Maintenance (a)	$7,260	$7,260	$4,914	$4,914	$7,260	$7,260
Monitoring	$44,812	$46,864	$36,113	$30,696	$56,237	$74,982
TOTAL	**$97,653**	**$102,519**	**$104,048**	**$80,214**	**$115,994**	**$134,350**

(a) Plan maintenance includes minimum expenses to maintain a plan during non-revision years, excluding assessment, collaboration, and analysis/decision costs associated specifically with amendments.

Table 7. Net Cost Change From Current Rule Procedures (For All Units in $1,000 Per Year)

Planning Activity	Modified Alternative A	Alternative A	Alternative C	Alternative D	Alternative E
Assessment	$773	$3,883	($2,186)	$5,777	$3,883
Collaboration	$9,395	$9,395	$0	$9,395	$13,107
Analysis/Decisions	($26,720)	($27,270)	($16,230)	($25,062)	($27,270)
Science Support	$343	$597	$0	$597	$597
Resolutions	($1,230)	($1,230)	$0	($1,230)	($1,230)
Plan Maintenance (a)	$2,346	$2,346	$0	$2,346	$2,346
Monitoring	$8,699	$10,751	($5,417)	$20,123	$38,869
TOTAL	**($6,394)**	**($1,528)**	**($23,833)**	**$11,946**	**$30,302**

(a) Plan maintenance includes minimum expenses to maintain a plan during non-revision years, excluding assessment, collaboration, and analysis/decision costs associated specifically with amendments.

Alternatives A and Modified Alternative A Effects Relative to Alternative B

Long-term gains in planning efficiency are expected as a result of procedural changes and redirection of effort (and costs) across key planning activities under Alternative A and Modified Alternative A compared to Alternative B. Planning activities such as analyzing and revising plan components are anticipated to be streamlined as resources are shifted to other activities such as collaboration, assessments, and monitoring. These shifts in emphasis and resources are also projected to improve the currency, reliability, and legitimacy of plans to serve as a guide for: (1) reducing uncertainty by increasing opportunities to gather (and exchange) new information from a wide spectrum of sources and interested parties about conditions, trends, risks, stressors, contingencies, vulnerabilities, values/needs, contributions, and management constraints; (2) integrating and assessing ecological, social, and economic information to determine if unit contributions are in need of change; and (3) responding to a need for change through management activities and projects, plan amendment, or plan revision. .

A learning curve is expected under Alternatives A and Modified A, due in part to reallocation of resources across different planning tasks and greater emphasis on collaboration, broader-scale monitoring, a coarse-filter and fine-filter approach for diversity, rapid assessments, and other procedures. During the initial efforts by management units to develop, revise, or amend plans under Alternatives A or Modified A, costs are expected to reflect additional time and resources needed to adjust to a new planning framework, including training. Still, efficiency gains are expected during the initial planning efforts. And, as the new process becomes established, planning costs in subsequent planning cycles are expected to decrease. New requirements to consider diversity and sustainability in monitoring, assessments, and plan components are expected to improve the foundation for designing cost-effective projects (recalling that project-level costs are not included in the analysis of planning costs). Details about the potential effects of specific procedural changes on Agency costs and planning efficiency are described below, by activity category.

Gains in planning efficiency and cost effectiveness are projected to be similar under Alternatives A and Modified A, compared to Alternative B. Agency planning costs under Modified Alternative A are estimated to be slightly lower than Alternative A (see

"Agency Cost Effects" above); however, due to the relatively small differences in estimated costs, combined with uncertainty associated with costing assumptions, the estimated costs are not projected to be substantially different between Alternative A, Modified Alternative A, and Alternative B. Long-term gains in planning efficiency are likewise expected to be similar under Alternatives A and Modified A for the same reasons noted above. Compared to Alternative A, relatively less effort is reallocated toward the assessment phase, while slightly more effort is re-directed back to activities associated with development and analysis of proposed plans or amendments (i.e., analysis and decision phase) under Modified Alternative A. Changes in rule language under Modified Alternative A will clarify the intent of Alternative A and enhance the gains in planning efficiency under Alternative A, as described in subsections below.

Assessment

Slight increases in assessment costs are anticipated under the Alternatives A and Modified A, relative to Alternative B, because of the increased emphasis on assessing a number of factors (e.g., conditions, trends, and sustainability within a broader ecological and geographic context [landscapes], ecosystem and species diversity, climate change, and other system drivers, risks, threats, and vulnerabilities). Gains in cost effectiveness are achieved through other elements such as requirements to rely on existing information and removal of prescriptive benchmark analysis. Changes in the following assessment requirements and guidance are expected to increase planning efficiency by improving capacity to assimilate and integrate new information under Alternatives A and Modified A:

- Assessments are to be conducted at landscape levels and at a geographic scale based on ecological, economic, or social factors, rather than relying on administrative boundaries, thereby enhancing capacity to incorporate information about conditions outside of National Forest System (NFS) boundaries;
- Risks and vulnerabilities to ecosystems are to be considered in assessments, thereby encouraging consideration of the effects of long-term environmental or social/economic variability, events, and trends on future outputs, ecosystem services, and outcomes (e.g., climate change); and
- Agency costs for broad-scale assessments might be offset in part by considering and referencing existing assessments completed by other branches in Forest Service, other Federal agencies, States, and other entities.

For Modified Alternative A, the level of effort, or reallocation of effort (and cost) to the assessment phase is reduced due to greater emphasis on more rapid evaluations of available information (e.g., assessments completed by States and other entities, etc.). Explicit requirements for assessments to address roles and contributions, the need to change, as well as monitoring questions have been removed under Modified Alternative A. The benefits people obtain from NFS planning areas (ecosystem services) have been highlighted for assessments under Modified Alternative A, implying that units may be better prepared to identify need-to-change associated with unit contributions to ecosystem services. Assessments of species of conservation concern are more explicit (and transparent) under Modified Alternative A. The changes in assessment requirements

under Modified Alternative A are expected to improve the cost effectiveness of assessments. These changes are also designed to increase the likelihood of improving capacity to respond to changes in conditions and trends, as originally intended under Alternative A.

Collaboration

Requirements for public participation (including collaboration) do not change substantially between Alternative A and Modified A (219.4). Costs associated with collaboration are projected to increase under Alternatives A and Modified A primarily because of requirements that opportunities for participation, including collaboration where feasible and appropriate, be provided throughout the planning process. Efforts to help insure the effectiveness of collaboration under Alternatives A and Modified A could occur, in part, by providing responsible officials with discretion to design collaboration strategies that meet unit-specific needs and constraints and recognize local collaboration capacity.

Neither collaboration nor public participation can guarantee a successful process or a better decision from the perspective of every participant. Collaborative approaches could raise issues of legal, participatory, and scientific legitimacy. Collaboration costs for some units could be higher where potential barriers to collaboration are present (e.g., pre-existing relationships might exacerbate perceived inequalities in representation absence of pre-existing social networks or capacity; potential for coercion or false commitments). In an effort to address these challenges, Alternatives A and Modified A provide responsible officials with discretion to determine the scope, methods, and timing of collaborative activities appropriate to local circumstances, and Modified Alternative A states that opportunities for collaboration be offered when feasible and appropriate.

Changes in guidance and requirements for participation and collaboration under Alternatives A and Modified A, compared to Alternative B are expected to increase planning efficiency as a result of the following:

- Improved likelihood of addressing uncertainty by gathering, verifying, and integrating information from a variety of sources, including tribal or other forms of knowledge and land ethics, within and beyond unit boundaries;
- Improved capacity to consider values and concerns for all economic sectors and social segments, including amenity-driven demographic shifts associated with local or rural communities in wildland dependent counties.
- Improved analysis and decisionmaking efficiency during latter stages of planning due to increases in public participation and collaborative efforts during early phases (e.g., assessments);
- Potential to offset or reduce Agency monitoring costs at the unit level as a result of collaboration during monitoring program development and monitoring itself;
- Reduced need for large numbers of plan alternatives as well as time needed to complete plan revisions as a consequence of broader support and resolution of

issues achieved through collaboration during early phases of proposed plan development (see "Transparency and Collaboration" section in this chapter);

- Improved public perceptions about the legitimacy of plans and the planning process and improved Agency ability to address issues and concerns before becoming the basis for litigation. Participation and collaboration may provide opportunities for increasing transparency; developing awareness about the values and expected behavior of others; and seeking greater understanding about values, needs, tradeoffs, and outcomes during earlier stages of planning;
- Expectations about building unit (and regional) capacity to overcome existing barriers to collaboration (e.g., absence of social networks or capacity; perceptions about pre-existing power relationships) through training and facilitation.

For details about the potential benefits and challenges associated with collaboration see "Transparency and Collaboration" section within this Chapter.

Analysis and Decisions (Plan Revision or Amendment)

Costs associated with analysis and decisions are estimated to decrease under Alternative A due to the net effect of changes in requirements regarding plan components, plan content, and the development and evaluation of proposals. Examples of changes that may reduce or have uncertain effects on costs include: (1) fewer procedural requirements (relative to Alternative B) regarding number and types of alternatives that need to be developed and evaluation of alternatives; and (2) more efficient approaches for addressing species viability and diversity. Examples of changes that may increase costs include increased emphasis on consideration of resource attributes and conditions such as sustainability, watershed health, and water supply. The following elements associated with Alternatives A and Modified A are expected to increase planning efficiency by facilitating plan revisions and amendments, increasing the potential for adaptive management, and improving guidance for responding to need for change determinations:

- The adoption of new approaches for addressing species viability and diversity within plan components, while recognizing local land and unit capabilities and limits, is expected to increase the flexibility and feasibility of responding to species and ecosystem sustainability and recovery needs (habitat quality and quantity would be expected to increase).
- Consideration of sustainability and ecosystem resiliency or integrity in the development of plan components is expected to facilitate restoration responses triggered by new information regarding environmental, social, and economic risks and stressors, including climate change and market trends. Expected results of these considerations include reduced effects from anthropogenic stressors, thereby helping to restore healthy ecosystems and compatible uses (especially in areas sensitive to disturbance and changing conditions) as well as increased protection of riparian area function.
- Refocusing the use of the term "restoration" to focus on recovery of resiliency and ecosystem function (instead of historical reference points) provides greater flexibility to respond to need for change regarding damaged ecosystems.

- Emphasis on evaluating ecosystem resiliency or integrity and contributions to social and economic sustainability should result in the plan components that provide a better foundation for guiding restoration projects that are linked to local or rural community conditions, including support for economic opportunities and demographic shifts driven by forest resource amenities.
- More frequent amendments expected under Alternative A could potentially lead to fewer need for change determinations when plans are revised. Assessments and proposal steps may not be needed for some amendments.
- Descriptions of each unit's role in providing ecosystem services within a broader landscape or region should facilitate the design of management action that reflects the incremental effects of a unit on ecological, social, or economic conditions outside of the traditional unit study area boundaries.

Under Modified Alternative A, slightly more effort is re-directed back to activities associated with development and analysis of proposed plans (or amendments) compared to Alternative A. Examples of changes under Modified Alternative A that can enhance overall planning efficiency include:

- Moving need to change determinations from assessments to the plan revision phase to clarify the separation between the assessment and NEPA phases;
- Clarifying how plan area ecosystems are integrated into landscape-level ecological, social, and economic sustainability;
- Refining and clarifying requirements for standards and guidelines for riparian zones; and
- Clarifying unit responsibilities for diversity by noting that plans must include plan components for providing ecological conditions to maintain the diversity of plan and animal communities.

These additions are expected to contribute to planning efficiency by improving the capacity of plans to provide for sustainability and diversity.

Science Support

Slight increases in costs for science support might occur under Alternative A owing in part to more prescriptive language to document in assessment reports, plan decision documents, and monitoring evaluation reports how the best available scientific information was taken into account. The guidance and requirements for taking into account the best available scientific information under Alternative A contributes to planning efficiency by maximizing coverage of scientific input from diverse sources, integrating science throughout all stages of planning, and taking advantage of scientific knowledge from external partners and Agency research stations. Efficiency gains under Modified Alternative A are expected to be similar to Alternative A with the exception that Modified Alternative A has fewer documentation requirements and therefore concentrates documentation burden on the most relevant and appropriate points in the

planning process[4]. Additional changes are made to clarify the responsible official's use of the best available scientific information to inform the planning process.

Resolutions

The effect of a shift from a post-decisional appeals process (under current rule procedures) to a pre-decisional objection period under Alternatives A and Modified A is difficult to project. Litigation under the current planning rule has been costly and time consuming and may continue under the new rule. However, the planning framework under Alternatives A and Modified A, including (i) greater emphasis on public participation and collaboration, (ii) adoption of a pre-decisional objection process, and (iii) changing the regional office responsible official from regional forester to forest supervisor, is expected to result in perceptions of legitimacy and trust in the planning process and more efficient resolution of issues early in the process, prior to the revision or amendment approval. Making a decision on an objection before plan approval can be less disruptive than an appeal decision which can come months after plan implementation begins. There is no expectation of unanimous support for any given proposed plan revision or amendment under any of the alternatives, however early resolution of issues is expected to occur and contribute to overall planning efficiency under Alternatives A and Modified A. Efficiency gains under Modified Alternative A are expected to be similar to Alternative A for resolutions, recognizing that the objection period for actions involving environmental impact statements is extended to 60 days under Modified Alternative A.

Monitoring

Compared to current practices, relative increases in monitoring costs are anticipated as a consequence of greater emphasis on broader input and participation in design and implementation of monitoring, adopting new approaches for addressing plant and animal diversity and ecological integrity, and two- level monitoring programs under Alternatives A and Modified A (i.e., "plan area" program and broader-scale strategy). Monitoring requirements such as coordination of broad-scale monitoring strategies, as well as changing from monitoring of population trends of management indicator species to the status of focal species and key ecological conditions as measures for diversity are expected to contribute to monitoring cost-effectiveness. The following changes in guidance and requirements for monitoring under Alternatives A and Modified A are expected to increase planning efficiency by improving the likelihood that information will be gathered to reduce uncertainty for a number of integrated ecological, social, and economic conditions, trends, risks, stressors, constraints, and values, within and beyond unit boundaries:

- Monitoring focuses to a greater extent on ecosystems, habitat diversity, and smaller numbers of species to monitor (relative to MIS under Alternative B), with

[4] Science support costs under all alternatives are assumed to include the continuing need to satisfy U.S. Department of Agriculture policy[4] regarding data quality requirements (see USDA guidelines for information quality at http://www.ocio.usda.gov/qi_guide/background.html).

the intent that tracking of species diversity and habitat sustainability will be more cost-effective and reflective of unit-specific capabilities.

- Two levels of monitoring (unit-specific or "plan area" and broader-scale) is intended to create a more systematic and unified monitoring approach to detect effects of management within unit boundaries as well as track risks, stressors, and conditions that extend beyond unit boundaries and that affect or are affected by unit conditions and actions.
- Emphasis on coordination between the unit monitoring program and broader-scale monitoring strategy is expected to help ensure information is complementary and gathered at scales appropriate to monitoring questions, thereby reducing redundancy and improving cost-effectiveness.

Efficiency gains under Modified Alternative A are expected to be similar to Alternative A. Changes to monitoring requirements under Modified Alternative A should enhance those gains by: (1) clarifying that monitoring information should inform need to change determinations, (2) refining the intent of monitoring to address desired conditions within the plan area (in addition to a number of other factors), (3) clarifying the links between monitoring and the status of focal species and ecological conditions, and (4) changing "unit" monitoring program to "plan" monitoring program.

Alternative B Effects

Alternative B (current rule procedures) is the No Action alternative, and as such, the current trends regarding planning and planning outcomes (e.g., plan revisions and amendments) will likely continue. The planning challenges associated with significant issued outlined in Chapter 1 of this report are likewise expected to continue to be of concern for a number of Forest Service units.

As illustrated in Table 6 (earlier in this section), the annual planning cost to the Agency under Alternative B is estimated to be $104 million per year which is similar to the annual costs estimated for Alternatives A and Modified A (given the inherent uncertainty associated with costing methodologies). However, the incremental gains in planning efficiency described under Alternatives A and Modified A are less likely to occur under Alternative B. As evidenced in other sections of this EIS some recently revised plans incorporate concepts, if not actual requirements of Alternative A even though not required. Under Alternative B, this trend is expected to continue, albeit voluntarily. Consequently, there would be no assurance that plans would exhibit content beyond that which is required in the current rule procedures or that there would be consistency across NFS units.

Alternative C Effects

As indicated in Table 6 and Table 7(earlier), Agency costs increase for some key activities and decrease for others under this alternative. Some Alternative C costs are expected to be similar to current rule procedures. Notable exceptions are in the areas of assessment, analysis, and monitoring where lower costs are attributed to minimal requirements for these activities.

As illustrated in Appendix K the annual planning cost to the Agency under Alternative C is estimated to be $80 million per year, which is $23 million per year (22 percent) lower than Alternative A (Alternative A) and $24 million per year lower than the current rule procedures (Alternative B, no action).

Alternative C can be considered to be a modification of Alternative A (Alternative A) whereby many prescriptive requirements for the key planning activities are removed. As such, changes in Agency costs for these alternatives are described, by planning activity, as qualitative or percent changes with respect to Alternative A.

The level of environmental analysis and documentation for plan development, revision, and amendment would be dictated by Agency NEPA procedures at 36 CFR part 220. Therefore, this alternative, unlike any of the other alternatives, does not require an environmental impact statement required for every new plan or revision. Rather, the significance of predicted environmental impacts would dictate the level of analysis and documentation. It is expected, though not inevitable, that the nature and complexity of developing or revising a land management plan would lead to preparation of an environmental impact statement. Given this expectation, preparation of an environmental impact statement is assumed for purposes of comparing costs among the alternatives.

Alternative C describes minimum levels of planning activity necessary for meeting the purpose and need associated with NFMA. Costs for Alternative C are characterized in terms of changes with respect to Alternative A (proposed rule). Science support costs are assumed to be similar to costs estimated for Alternative B, recognizing the continuing need to satisfy U.S. Department of Agriculture policy[5] regarding data quality requirements (see USDA guidelines for information quality at http://www.ocio.usda.gov/qi_guide/background.html).

Requirements for using a collaborative process are retained under Alternative C. However, all prescriptive requirements for the collaborative process are removed with the exception of the responsible official having discretion about the design and scope of the process. As a consequence, collaboration costs are assumed to be equivalent to costs under Alternative B.

Prescriptive requirements regarding monitoring under Alternative A, as well as Alternative B, are not included in Alternative C. Monitoring costs are therefore assumed to be equivalent to Alternative B monitoring costs minus the costs of annual and 5-year evaluations as well as effort required to address management indicator species and other prescriptive considerations under Alternative B. These additional cost deductions are

[5] USDA information quality policy is based largely on Office of Management and Budget's (OMB) Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by Federal Agencies (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001 (Public Law 106-554)), now commonly referred to as the Data Quality Act.

estimated to be approximately 15 percent of Alternative B monitoring costs based on past analyses[6].

Prescriptive requirements regarding assessments under Alternative A are not included in Alternative C, and it is assumed that similar requirements under Alternative B would likewise not apply (e.g., requirements associated with analyses of management situations (AMS), benchmark analyses, regional guides, and evaluation of MIS). As a consequence, assessment costs under Alternative C are projected to be 25 percent lower than assessment costs estimated for Alternative B.

Costs related to post-NOI requirements for completing plan revisions and amendments and complying with NEPA (i.e., development and evaluation of alternatives, analysis of effects, provide notifications and opportunities for comment, decision documentation, public records, etc.) would remain in effect under Alternative C; however, all prescriptive language regarding development and evaluation of alternatives under Alternative B and Alternative A would not apply. Plan components and NFMA timber requirements under Alternative A would also be required in Alternative C, as would most requirements to consider sustainability, climate, diversity, and restoration; however, Alternative C does not include much of the prescriptive language for considering these factors that Alternatives A and B require. Given the absence of any requirements in Alternative C for collaboration during early phases of plan revision and amendment, a greater number of plan alternatives are expected to be needed under Alternative C, relative to Alternative A. Analysis and decision costs under Alternative C are therefore assumed to be significantly lower than costs under Alternative B, but more than analysis costs projected under Alternative A by 50 percent.

There is potential for costs associated with resolving objections under Alternative C to increase relative to Alternative A as well Alternative B; however, it is difficult to predict changes in resolution costs. Resolution costs under Alternative C are therefore assumed to be equivalent to those estimated for Alternative B.

Alternative C does not include most of Alternative A's prescriptive requirements designed to enhance collection of new information, assimilation and evaluation of new information for determining need for change, and response to need for change during plan revision or amendment Agency costs would be substantially lower as a consequence. However, in the absence of these requirements, management units are not expected to be able to reduce uncertainty and respond to new information about environmental, economic, and social stressors and risks in a manner that allows them to establish plans that sustain multiple uses and maintain long-term productivity, thereby providing benefits to human communities. The capacity to consider new values linked to demographic shifts and economic development in amenity dependent counties is expected to decrease under Alternative C compared to Alternative A.

[6] Total costs for annual reviews and 5-year evaluations are estimated to be approximately $500,000 over a 15-year planning period based on costs estimated for the 1982 rule (USDA Forest Service 2007

The numerous public meetings, forums, and roundtable discussions, convened as a result of this rulemaking effort, revealed growing concern about a variety of risks and stressors (e.g., climate change; insects and disease; shifts in recreation, timber, and other local demands and national market trends; population growth; demographic shifts; and concerns about water supply and other ecosystem support services). Addressing these types of risks requires a larger landscape perspective, exchange of information with an expanding spectrum of sources and users, and a framework that can facilitate adaptation to new information about risks and stressors. The new procedural requirements in Alternative A are designed to consider the need to address these risks and increase the likelihood that the Agency as well as units will adapt management plans to new and evolving information about risks, stressors, contingencies, and management constraints. In the absence of this prescriptive direction, it is anticipated that management units would be less likely to establish plans that are adaptable to new information.

A majority of the potential planning efficiency gains listed for Alternative A (see previous section) would be absent or reduced under Alternative C for individual management units; losses in planning efficiency are also expected to occur as a result of decreased likelihood for the Agency's research units, regional offices, and the Washington Office (as well as other Government agencies and organizations) to coordinate with and support planning at the unit level. The extent to which these losses might be reflected in potential changes in time needed to complete plan revisions is difficult to estimate; however, it would be expected that revision times under Alternative C would be longer than Alternative A and closer in length to times under Alternative B (current rule procedures). Even though Agency costs are substantially lower under Alternative C compared to Alternatives A or B, overall planning efficiency is expected to be less because of the of the reduced likelihood that management units would revise and maintain management plans that adequately address uncertainty and reflect current knowledge about social, economic, and ecological risks, stressors, and contingencies.

Alternative D Effects

As indicated in Table 6 and Table 7 (earlier in this section), costs are projected to be redirected toward collaboration, assessment, and monitoring activities and away from analysis/decision tasks compared to the current rule procedures. Costs are also redirected more toward non-revision periods (i.e., plan amendments and maintenance) under these alternatives, in part because of the reduced number of years anticipated to be needed for plan revisions. Time (and therefore costs) needed to complete plan revisions is assumed to be the same as Alternative A as a consequence of broader support and resolution of issues during collaboration associated with development of plan proposals (i.e., prior to proposing or finalizing action).

Alternative D can be considered to be a modification of Alternative A (Alternative A) whereby prescriptive requirements for key planning activities are adjusted or augmented. As such, changes in Agency costs for these alternatives are described, by planning activity, as qualitative or percentage changes with respect to Alternative A.

Alternative D (i.e., greater emphasis on riparian and watershed health, climate change vulnerability assessment, and alternative approach to species diversity) contains more

explicit requirements about preparing a "climate change vulnerability assessment," refining conservation area boundaries, and including watershed sustainability and watershed health guidelines and standards in plan components. The climate change vulnerability assessment requirement could increase assessment costs slightly for all management units. However, more explicit requirements regarding watershed health, standards, and guidelines in plan components might increase analysis/decision costs only for those units where these issues are not already priority issues, the overall effect being more consistent coverage of watershed health and protection within plan components. Many of the explicit requirements regarding consideration of watershed health in plan components are implicit within plan component requirements under Alternative A and might therefore have little effect for those units where watershed health and protection has already been identified as a relatively higher priority concern. Based on these changes, there is potential for higher costs for assessment, analysis/decision, and monitoring activity categories under Alternative D with respect to Alternative A (proposed action).

Alternative D also provides additional guidance and requirements regarding monitoring, assessment, and developing plan components, compared to Alternative A. Additional prescriptive language regarding coordination with other agencies, governments, organizations, and partners in the assessment and monitoring of species viability could increase initial costs related to collaboration, monitoring program development, and assessment, compared to Alternative A; however, more consistent coordination might also result in more cost-effective long-term planning efforts to meet viability objectives. Prescriptive coordination requirements for species viability add focus but are nonetheless comparable to requirements in Alternative A. Successful coordination could also provide increased opportunities to distribute and share monitoring and assessment costs as well as for more cost-effective monitoring strategies under Alternatives A and D. More prescriptive requirements regarding utilization of best scientific information under Alternative D could result in slightly higher costs associated with the "science support" activity category than Alternative A. However, similar support could be called for under Alternative A. Therefore, the overall difference in Agency costs for science support between Alternative D and A are expected to be negligible. The provisions related to species diversity are expected to require monitoring of more species than contemplated in Alternative A.

The aggregate effect of the changes in planning requirements regarding consideration of watershed health, climate change, and viability are projected to result in 15 percent higher assessment costs, 10 percent higher analysis costs, and 20 percent higher monitoring costs, compared to Alternative A. As a result of these differences, annual Agency planning costs under Alternative D are projected to be $116 million per year, which is $14 million per year (13 percent) higher than Alternative A (Alternative A). Total planning costs under Alternative D are estimated to be $12 million per year (12 percent) higher than the 1982 rule procedures (Alternative B, no action).

New prescriptive requirements under Alternative D might provide greater assurances about consistent and comprehensive coverage of issues related to riparian and watershed health protection, resilience of aquatic environments, and vulnerability to climate change

within management plans. However, Agency planning costs are estimated to be greater (13 percent) under Alternative D, compared to Alternative A, and potential improvements in planning efficiency might be limited to those management units where uncertainty and concerns about potential watershed problems and vulnerability to climate change are greatest. Similar to Alternative A, increased participation and collaboration under Alternative D is expected to provide more opportunities to consider values and concerns associated with rural amenity-dependent counties. More explicit requirements regarding vulnerability assessments, conservation area refinements, and consideration of watershed and species viability in plan components may increase the potential for sustaining local economic opportunities that rely on resiliency of forest ecosystems and corresponding amenities.

Many of the explicit requirements for watershed protection under Alternative D are implicit within plan component requirements under Alternative A. This suggests there is limited potential for incremental improvements in planning efficiency under Alternative D, even for units where watershed and climate change concerns and uncertainty are greatest. For those units where watershed issues are better understood and considered, compliance with additional prescriptive requirements under Alternative D could mean higher Agency costs than under Alternative A, without additional benefits to planning efficiency. Information about aquatic ecosystem integrity and resilience, restoration strategies, and priority watersheds gained from collaboration, consultation, and broad-scale monitoring requirements already specified in Alternative A might reduce the incremental gains or benefits of having more prescriptive requirements regarding vulnerability assessments and conservation boundaries in Alternative D. These requirements could help reduce the amount of time needed to complete plan revisions for some management units but might increase revision time for other units; it is difficult to project the overall impact of these requirements on time for completing revisions.

Some units could see isolated improvements in planning efficiency from more explicit requirements about vulnerability assessments, refining conservation area boundaries, and consideration of watershed sustainability and health guidelines under Alternative D. However, overall potential for increased planning efficiency might be limited given the magnitude of estimated increases in Agency costs combined with the potential for efficiency gains to occur only on isolated units with specific watershed needs and vulnerabilities.

Monitoring under this alternative would focus more on focal species rather than on key ecosystem characteristics. The alternative requirements aimed at species diversity in Alternative D rely more heavily on population surveys of focal species as the primary measurement for assessing overall effectiveness of plan components for supporting species diversity. The additional required plan monitoring elements under this alternative are more likely to assess the overall effectiveness of plan components toward maintaining biological diversity within the plan area in a more accurate and timely manner than under the other alternatives.

Alternative E Effects

Alternative E can be considered to be a modification of Alternative A in that Alternative E augments the prescriptive requirements for assessment, monitoring, and collaboration of Alternative A. Alternative E would require scenario planning or building as part of assessments conducted for plan revision. Alternative E may therefore have some short-term higher costs than A, associated with training necessary to learn the methods during transition periods as forests start to apply scenario planning. The method relies heavily on collaborative engagement between participants—including but not exclusively technical experts and scientists. Other agencies, such as National Institutes of Health and Department of Defense, have processes for scenario planning that are accepted as effective approaches to characterizing plausible futures where uncertainty is high and risks are profound. The method helps bring biases and assumptions to the surface so they can be used to construct the plausible alternative futures (see Appendix K "Agency Cost Assumptions" for more details about scenario building). Although scenario planning is more explicit in Alternative E, nothing in the other alternatives precludes scenario building.

Alternative E would require signals or criteria for action for each monitoring question and indicator; a somewhat more prescriptive list of factors to consider in monitoring and assessment questions; and new standards for periodic evaluations of monitoring programs. The requirements regarding 'signal points' and evaluations of monitoring programs could increase monitoring costs slightly for all management units. However, depending on the extent to which specific resource areas or programs are already targeted as a priority or concern for monitoring, costs for a smaller subset of management units could increase because of more explicit requirements regarding (1) the need to address sustainability, diversity, and timber requirements in assessments; (2) new factors to be addressed in monitoring questions (e.g., recovery of threatened and endangered species, vegetation diversity, insects and pathogens, goods and services contributing to economic sustainability, safety and environmental risks); and (3) more prescriptive language about addressing existing factors in monitoring questions (e.g., watershed conditions, key ecological conditions, invasive species, and climate change). Some of these explicit requirements are implicit within monitoring requirements under Alternative A and therefore less likely to have a significant cost impact for some management units.

Average monitoring costs per management unit could increase under Alternative E as a consequence of the need to (1) adjust current unit monitoring programs to improve consistency for some topics (30 percent increase) and (2) initiate new and additional monitoring for other topics (55 percent increase). However, there could be a reduced effort from consistency of methods and information management support that might offset the increased costs by an estimated 25 percent. Overall, the aggregate effect of the monitoring cost implications noted above is projected to result in a 60 percent increase in monitoring costs for Alternative E compared to monitoring costs estimated for Alternative A (proposed rule).

Alternative E also places greater emphasis on collaboration throughout all phases of planning. The expectations regarding effort dedicated to the creation of collaborative capacity and the ability to overcome barriers to collaboration, acknowledged to a limited

extent in the cost estimates for Alternative A, are made more explicit and expanded upon in Alternative E, particularly through prescriptive language regarding the process for creating a plan for public participation. Alternative E also provides additional collaborative opportunities for Tribes. Based on a review of estimates and analyses of collaboration costs completed for previous planning rules with extensive collaboration requirements (USDA Forest Service 2002a, 2007b), total collaboration costs under Alternative E, over a 15-year planning period, are estimated to be 35 percent higher than collaboration costs estimated for Alternative A. Annual Agency planning costs under Alternative E are projected to be $134 million per year, which is $32 million per year (31 percent) higher than Alternative A and $30 million per year (29 percent) higher than the current rule procedures.

Alternative E's prescriptive requirements regarding monitoring program questions, monitoring indicators, and program performance could contribute to improvements in the consistency of monitoring program reliability, acknowledging that improvements or benefits might be concentrated in management units where existing uncertainty is high regarding significant issues and/or where monitoring programs are dated. However these benefits would be achieved by incurring costs estimated to be 17 percent higher than Alternative A to achieve monitoring consistency across all management units, some of which might have greater existing capacity to maintain or develop monitoring programs that satisfy known unit-specific assessment needs. Input and reviews received as a result of collaboration during monitoring program development, as well as consultation with research stations and other agencies during broad-scale monitoring under Alternative A (Alternative A), could serve as a substitute, in part, for the assurances regarding monitoring program reliability achieved through the additional prescriptive monitoring requirements under Alternative E.

Additional assurances about the extent and success of collaboration during planning could be achieved under Alternative E as a result of more procedural requirements regarding development of public participation plans. The benefits from these assurances might be most apparent for management units where potential barriers or challenges to collaboration are present. Increased opportunities may occur under Alternative E to recognize values and concerns associated with rural wildland dependent communities whose economies and demographics are driven in part by forest amenities. However, potential benefits from additional collaborative requirements might be offset by reduced flexibility and the added expense of complying with collaborative requirements in situations where collaborative capacity already exists or where fewer challenges are present. Correspondingly, the effect of additional collaboration (and monitoring) requirements on time needed to complete plan revisions is expected to be a function of unit-specific conditions, with the average net effect being difficult to estimate.

Under Alternative E, isolated improvements in planning efficiency for some units could result from (i) more explicit requirements about signals for monitoring questions, (ii) more factors to consider in monitoring questions, (iii) periodic evaluations of monitoring programs, and (iv) development of strategies for public participation (collaboration).However, the overall potential for increased planning efficiency as a result of these requirements might be limited, given the magnitude of estimated increases

in Agency costs combined with the potential for efficiency gains to occur only on isolated units where substantial improvements are needed in monitoring performance and collaborative capacity.

TRANSPARENCY AND COLLABORATION

Affected Environment

Literature on the best practices in public involvement and collaboration emphasizes the importance of engaging a broad spectrum of participants from the full community of interests (Burby 2003, Chrislip 2002, Healey 2003, Innes and Booher 2003, Margerum 2008, USGAO 2004). Members of that community of interests might live close to a plan area or not, because proximity is not necessarily reflective of interests or even attachment (Kruger and Williams 2007). What matters is that they care about that area for some reason, can contribute to a wise understanding of relevant issues, can help get work done, and can help grow organizational and community capacity (Wondolleck and Yaffee 2000).

A plan revision or amendment process that offers a broad spectrum of participation opportunities is much more likely produce a meaningful, shared understanding of the social, economic, or ecological factors of importance in the plan area (Burby 2003, Stern and Fineberg 2003). As a result, the desired conditions, objectives, standards, and guidelines in the plan would then capture more accurately the issues of most importance and the areas of uncertainty that require the most extensive monitoring (Burby 2003, Johnson et al. 2003, Lasker and Weiss 2003, Margerum 2008).

Forests and grasslands that already engage a broad spectrum of public interests early and often report that their proposed projects and plans more accurately incorporate public vision and interests. They further report that upfront public involvement builds more understanding of proposed actions, and that people typically respond more effectively to proposals (USOMB and Council on Environmental Quality 2008). This well-substantiated anecdotal evidence is consistent with empirical research findings based on studying alternative dispute resolution practices applied by the Forest Service during land management plan revision efforts (Manring 1998).

The restoration of Fossil Creek on NFS lands in Arizona (see box) serves as an example of watershed restoration achieved through collaboration efforts on the Coconino and Tonto National Forests.

The Rebirth of Fossil Creek

"Situated in the high desert country of central Arizona, Fossil Creek has nurtured a rich diversity of life for millions of years. In the early years of the 20th century, however, the waterway was harnessed and turned to another purpose: the generation of electricity to power copper mining operations in the region. Now, in a historic turnaround, the hydroelectric facilities are being decommissioned and the river returned to its natural state. . . .

"One of the most remarkable features of the Fossil Creek story is the fact that the decision to decommission the hydroelectric facilities was reached without litigation. A number of private environmental organizations, State and Federal agencies (including the USDA Forest Service), and Arizona Public Service, the owner and operator of the dam, reached a comprehensive agreement through constructive engagement and dialogue. The result is a notable "win-win" settlement that is worthy of wide attention, especially at a time when debates over environmental protection are more often characterized by friction and heat than by reason and light. Fossil Creek provides a rare and encouraging case study in the cooperative resolution of environmental disputes, and it will be of great value to individuals and organizations involved in conservation and restoration projects across the U.S."

Source— http://www.watershed.nau.edu/fossilcreekproject/index.htm

Much of the literature on building effective collaboration discusses the need for flexibility to select public involvement methods appropriate for the unique needs of specific situations and participants (Burby 2003; Chopyak and Levesque 2002; Chrislip 2002; Innes and Booher 2003, 2004; Johnson et al. 2003). Additionally, a collaborative approach to diagnosing and understanding those unique needs and to proposing ideas for appropriate process design criteria can positively affect the sense of fairness, sometimes called procedural justice, that participants associate with a planning process (Korsgaard et al. 1995, Wondolleck and Yaffee 2000). A greater sense that a planning process is fair can increase the willingness of those participants to help get the job done because it increases the sense of ownership in the outcome as well as the process (Wondolleck and Yaffee 2000, Ansell and Gash 2008) and can increase trust among participants (Chopyak and Levesque 2002, Korsgaard and Schweiger 1995, Selin 2007). Trust is a crucial social aspect of resource management because, without it, management efforts are much more challenging and resulting decisions are typically lower quality and less durable (Leahy and Anderson 2008; Selin 2006). Yet, focusing management efforts on increasing trust as an objective appears less promising than focusing on establishing a trustworthy—meaning understandable and acceptable—process (Trettin and Mushram 2000). National Forest System units are located in a diverse range of communities and settings across the United States; the best collaboration strategies for plan development, revision, and amendments, therefore, would vary as well to meet the needs of participants, including the typically common need to see the eventual plan make a difference, and would focus on establishing an understandable and acceptable process.

The need for flexibility is matched by the availability of a wide range of diverse approaches to public participation and collaboration. Some approaches are quite formal, as with traditional public involvement and public comment practices, while others are quite informal (Chambers 2002, Williams and Blahna 2007). The International Association of Public Participation (http://www.iap2.org/) provides a wide range of examples and illustrations, most notably the IAP2 "Spectrum of Public Participation" and IAP2 "Public Participation Toolbox," to illustrate this point.

While many regard collaboration and public participation as useful for reasons already mentioned, neither collaboration nor public participation are a panacea because there is no guarantee of a successful process or a better decision from the perspective of every participant. One simple reason is that success can have very different meanings. There are more technically complicated reasons, too. For example, collaborative approaches could raise issues of legal legitimacy should any perceived compromise of Agency authority occur; they could raise issues of participatory legitimacy should any perceived lack of consideration occur towards concerns raised by those who choose not to participate collaboratively; and they could raise issues of scientific legitimacy should any perceived conflicts occur between conclusions of a collaborative group and conclusions associated with established scientific or technical knowledge (Rossi 1997, Wondolleck and Yaffee 2000). Collaboration requires time and money on the parts of those who want to participate. Lack of funding may preclude some groups from participating, at least at some times.

A well-designed process, appropriate for the local situation and responsive to these and other concerns, typically can avoid these issues or offset the most problematic effects, but, even then, some stakeholders might be dissatisfied and choose to pursue procedurally based challenges. The role of choice is as central to the success of collaboration as it is to the inability of collaboration to guarantee a successful process or better decision from every perspective (Rossi 1997, Wondolleck and Yafee 2000, Williams 2006).

With respect to forest planning, existing provisions for public participation have relied primarily on the requirements for public involvement under the National Environmental Policy Act (NEPA). Under these requirements, the Agency must provide opportunities to comment on a proposed plan or plan revision, and on the disclosure of their effects. (Public participation in plan amendments varies with the nature of the proposed amendment.) First, the Forest Service initiates public scoping by publishing in the *Federal Register* a notice of intent (NOI) to prepare an environmental impact statement for the development of a plan or plan revision is published. The Forest Service considers the public comments submitted during the scoping period in establishing the scope of the analysis to follow. The Agency then publishes a draft environmental impact statement and a proposed plan, providing a second opportunity for public comment before the plan is finalized. More recently, some units have gone beyond these requirements and offered an additional opportunity for the public to comment and collaborate in planning by making draft plans available for comment prior to formal publication with a a draft environmental impact statement. For example, during the Blue Mountains Forest Plan Revision (consisting of the Malheur, Umatilla, and Wallowa-Whitman National Forests), a proposed plan was published at the same time as the Notice of Intent and available for the public to review and comment on during the scoping period. The Uwharrie National Forest began the scoping process for its plan revision by making a preliminary draft plan available on their website. The Prescott National Forest posted four versions of a proposed plan on their website, including rationale regarding the changes from one version to the next, prior to official publication of the proposed plan with the draft EIS.

The responsible official is also required to meet with landowners whose property is adjacent to NFS lands; to coordinate planning with other Federal agencies, State and local

governments, and Indian Tribes; and to engage other governments and universities to resolve management concerns and develop research questions for further study. Additional opportunities for public participation are encouraged but not required in the 1982 regulations (§ 219.6(d)). At several places in the existing rule provisions, public participation is encouraged as deemed appropriate by the responsible line officer.

To date, all approvals of new land management plans and plan revisions have been made by a regional forester, as required by the 1982 procedures. This means that the responsible official is not normally a member of a community in, near, or affected by a land management plan. While the responsible official was the regional forester, under the 1982 procedures, he local national forest or grassland supervisor has historically supervised and been engaged in the public involvement activities for planning and determined the significant issues and alternatives to be analyzed. The regional forester is less likely than the national forest or grassland supervisor to have a comprehensive understanding of local ecological, social, and economic concerns. On the other hand, the regional forester is more likely to be aware of regional, Agency, and national issues, initiatives, and politics.

Under current procedures, a responsible official may choose to provide a pre-decisional objection opportunity or post-decisional appeal opportunity for those who wish to challenge a plan approval decision. Both of these procedures involve an administrative review by an official at a higher level in the Agency than that of the decisionmaker.

The appeal process involves the filing of a written appeal to a reviewing officer who reviews the planning record and renders a decision to uphold or reverse the original decision. Other parties may intervene and file comments relevant to the appeal. The appeal process involves a sequence of one-way communication between the appellant and the reviewing officer, and could involve a second one-way sequence if a subsequent discretionary review is conducted at the next higher level. Appeal decisions and any subsequent discretionary review decisions are published on the Internet and are otherwise available to the public upon request.

While the objection process begins with the filing of a written objection, the review involves the opportunity for the objecting party, reviewing officer, responsible official, and any other interested party to meet and discuss issues raised in the objection. The reviewing officer then issues a written response to all of the objections, and the responsible official for plan approval then approves the plan with any changes needed to make it consistent with the responses to the objections.

Since the first land management plan using the 1982 rule planning process was issued in 1983, public participation has varied from units' providing only the formal notice and comment opportunities required by NEPA and NFMA to more robust engagement of the public at numerous stages of the planning process. Outreach methods beyond the statutory minimum have included more extensive outreach methods such as Web updates, mailed bulletins, newsletters, invitations to meetings, press releases, and radio announcements. The general trend over time has been for increased public outreach and involvement throughout the planning process. Many of the current plan revision

processes are actively engaging the public throughout the process — much more so than was undertaken in earlier plan development or revision efforts.

A review of eight recent plan revisions provided a sense of the scope and variation in recent public involvement efforts. Outreach methods in all these revisions went beyond the minimum requirements; specific methods included Internet updates, newsletters, press releases, and hard copy mailings. These additional outreach methods provided an opportunity to reach a broader range of interested or affected individuals than would occur using the minimum NEPA and NFMA requirements. Despite the lack of a collaboration requirement in the current planning procedures, the trend in recent plan revisions has been for the Forest Service to increasingly engage in collaborative activities with the public during the planning process. Of the eight recent revisions reviewed for this analysis, four used collaborative groups of some manner. Some of those four provided opportunities for the public to help develop the proposed plan, and some shared preliminary alternatives and then used the feedback to finalize the alternatives in the draft environmental impact statement.

Under current rule procedures, the responsible official notifies the public of the location and availability of documents relevant to the planning process. While this requirement does not specify that documents should be available on the Internet, the more recent plan revision documents have been made available through the Internet. Indeed, eight out of eight recent plan revisions reviewed made their proposed and final plans and associated documents available on the Internet.

As evidenced by the diversity of public involvement strategies used over the past 3 decades of land management planning, the existing procedures allow a large amount of flexibility for engaging the public in ways the responsible official feels are most appropriate to the local environment. The high level of flexibility has also meant that there are inconsistencies in the level of public involvement across NFS units. While the overall trend is for plan revision processes to offer extensive opportunities for public involvement, there is no current assurance that a high level of opportunities for public engagement would occur for any particular land management plan revision.

There are policies beyond the planning rule and Agency NEPA procedures that encourage collaboration and public involvement under each of the alternatives. The 2004 Executive Order 13352, Facilitation of Cooperative Conservation (69 FR 52989, August 30, 2004) directs Federal land management agencies to implement laws relating to the environment and natural resources in a manner that promotes cooperative conservation, with an emphasis on appropriate inclusion of local participation in Federal decisionmaking, in accordance with their respective agency missions, policies, and regulations.

More recently, in his memorandum for the heads of executive departments and agencies, the President committed Federal agencies to disclose information rapidly in forms that the public can readily find and use, in order to increase and improve public engagement and collaboration (http://www.whitehouse.gov/the_press_office/Transparency_and_Open_Government/). The President instructed the director of the Office of Management and Budget to issue an

open government directive to the heads of executive departments and agencies with specific actions to implement the principles of transparency, participation, and collaboration set forth in the President's memorandum (http://www.whitehouse.gov/open/documents/open-government-directive). The directive includes requirements to publish government information online, and to create and institutionalize a culture of open government by incorporating the values of transparency, participation, and collaboration into ongoing work.

Evaluation of the Alternatives

As a result of the Open Government Directive, all alternatives would involve readily available planning information and collaborative planning processes.

As discussed previously, there has been a trend over time for land management planning to involve more in-depth and extensive public involvement opportunities. Because Agency employees increasingly recognize the value of public involvement and collaboration and because of policies like the Open Government Directive, it is expected that under each of the alternatives, many units would continue to offer opportunities for public participation and collaboration in the planning process beyond what is currently required.

Primarily, the requirements for transparency and collaboration in each of the alternatives directly relate to the planning process itself and the content of plans. Thus, the format for the following discussion of effects for each alternative differs from the previously used format that divided the effects into two categories (effects on the planning process and plan content and effects on resources expressed as general outcomes over time).

Alternative A Effects

Under Alternative A, the responsible official would provide opportunities for the public to participate in: (1) preparing assessments for plan development, plan amendment, or plan revision; (2) developing a proposed plan, plan amendment, or plan revision; (3) commenting on the proposal; and (4) designing the monitoring program (§ 219.4(a)(1)). The responsible official would also provide a pre-decisional opportunity for filing an objection (§ 219.16). In total, four public notifications would be required before a plan could become final: one to start the assessment phase; a second to announce the beginning of plan development; a third to offer the proposed plan and draft PEIS for public comment; and a fourth to initiate the start of the objection process. All national forests and grasslands would provide people with opportunities to be involved in plan development, revision, or amendment from the very beginning of the process, and there would be an emphasis on using collaborative processes when feasible. By the time a proposed plan, plan revision, or amendment is published for comment, it would already reflect consideration of public input.

Throughout the planning process, the responsible official would take into account the discrete and diverse roles, jurisdictions, responsibilities, and skills of interested and affected parties in developing a collaborative approach to the planning process. The responsible official would also consider appropriate criteria, such as the diversity of

interests among potential participants and people's accessibility to process, discussion, and information in designing the planning process. The responsible official would also begin the planning process by thinking broadly about the unique suite of people and interests that need to be engaged in the unit's planning process.

Under this alternative, responsible officials would continue to engage State and local governments, Tribes, private landowners, other Federal agencies, and the public at large. In addition, responsible officials would also encourage participation by youth and low-income and minority populations, who have traditionally been underrepresented in the planning process (§ 219.4(a)). Alternative A sets out a public participation process that is designed to provide more opportunities for all affected parties, including small entities, to collaborate with the Forest Service and become more involved in all phases of planning, including monitoring, assessment, and development of alternatives for management plan revisions or amendments. These opportunities are expected to increase overall capacity to identify and consider the needs and preferences of small entities and reduce the potential for adverse economic impacts to those entities (USDA Forest Service 2010a). Responsible officials would have the discretion to determine the scope, methods, and timing of collaborative activities appropriate to local circumstances.

Under Alternative A, responsible officials would invite Tribes to share information about traditional knowledge, land ethics, and sacred and culturally significant sites during the planning process (§ 219.4(a)(7)). The responsible official would also provide opportunities for Tribes to participate in the planning process. The opportunities would be in addition to consultation opportunities with Tribes and Alaska Native corporations. Responsible officials would continue to honor the government-to-government relationship between federally recognized Indian Tribes and the Federal Government. As a result of these requirements, Tribes would have more consistent opportunities to participate in the planning process and there would be a stronger guarantee that the planning process is carried out with consideration of traditional tribal knowledge.

Under this alternative the public would also be involved in identifying potential monitoring needs (§ 219.12(c)(1)). More consistent public involvement in designing monitoring programs should result in monitoring that more accurately reflects the issues of most importance to a diversity of interests and communities and better identify the plan components that carry the most uncertainty.

Under Alternative A, the national forest or grassland supervisor would be the responsible official (§ 219.2(b)(3)). As a result, throughout the various public engagement activities discussed above, interested and affected parties would have the advantage of being able to interact directly with the responsible official. The direct interaction of the decisionmaker and the public throughout the planning process is expected to enhance collaboration and help produce plans that are developed through a process that considers the needs and concerns of the surrounding community.

Responsible officials would have flexibility to design public involvement strategies because Alternative A does not prescribe methods. The responsible official would have the discretion to determine the scope, methods, and timing of public participation opportunities, considering appropriate criteria such as: (1) diversity and spectrum of

interests among potential participants; (2) accessibility to processes, discussion, and information; (3) level of controversy and understanding of issues; (4) cost, time, and available resources; and (5) roles and responsibilities of the Forest Service and non-Agency participants.

Collaborative development of a proposed plan revision or amendment would capture a broad spectrum of public interests perhaps not otherwise reflected in an internally generated proposal. While there is no expectation of unanimous support for a proposed plan revision, it is likely that there could be fewer unresolved conflicts over alternative uses of available resources. The Council on Environmental Quality regulations at 40 CFR 1501.2(c) require agencies to "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts over alternative uses of available resources as provided by section 102(2)(E) of the Act." With fewer unresolved conflicts, fewer alternative courses of action might be warranted.

Alternative A would institute a pre-decisional objection process as the sole means to administratively challenge a plan, revision, or amendment (§ 219 Subpart B). This would eliminate a responsible official's current option to offer either a pre-decisional objection opportunity or what has been the traditional, post-decisional appeal opportunity. The objection process includes an opportunity for the objecting party, reviewing officer, responsible official, and any other interested party to meet and discuss issues raised in the objection before the responsible official approves the plan. These meetings are open to the public. Agency experience with the objections process to date has found that it strengthens the collaborative process because the objectors and the reviewing officer can collaboratively work through concerns before a responsible official approves a plan. To date, the objections process has been used for some plan amendments utilizing the 2000 planning procedures, but the Agency's primary experience with objections has been use of the process for certain proposed hazardous fuel reductions projects under 36 CFR 218. Meetings during the objection process are also open to the public, so that anyone with an interest in the plan can continue to participate.

Because the objection process would be the only way to administratively challenge a plan approval or amendment, Alternative A would ensure consistency in how the administrative challenge process works across all NFS units. This would be a change from the current procedures, which allow a choice between a post-decisional administrative review process and a pre-decisional objection process.

Process transparency would be achieved under Alternative A by making documents readily available to the public through the Internet and other means. Such documents would include: plans and monitoring programs, associated environmental documents, associated decision documents, assessment reports, monitoring evaluation reports, and documents supporting analytical conclusions and assumptions (§ 219.14(b)).

Modified Alternative A Effects

The effects of Modified Alternative A are the same as Alternative A with the following exceptions:

Based on public comment, the period for filing an objection was increased from 30 days to 60 days for plan development, revisions, or amendments that require an EIS; and to 45 days for those amendments that do not require an EIS (§ 219.56).

Also based on public concern that the requirements for documenting the best available scientific information (BASI) were too burdensome, the requirements for documentation of how BASI was taken into account in the monitoring evaluation reports were reduced to a requirement to document how the BASI was used to inform the design of monitoring program (§ 219.3). Based on these same concerns, the criteria for what the documentation must include were also eliminated. The criteria were also considered unnecessary because both the Department and the Agency have policies for data quality and the use of BASI. Those policies provide the direction for what is to be included in the documentation. These changes reduce some process burden, allow for adaptation as policies on the use of BASI change, but do not change effects on resources because the standard for use of BASI remains the same under Modified Alternative A as under Alternative A.

USDA information quality guidelines can be found at http://www.ocio.usda.gov/qi_guide/index.html; additionally, USDA guidelines for scientific research and peer review can be found at http://www.ocio.usda.gov/qi_guide/scientific_research.html. In August 2011, the Secretary of Agriculture also established the USDA Scientific Integrity Policy (http://www.ocio.usda.gov/directives/doc/SM1074-001.htm). Forest Service direction can be found in Forest Service Manual 1909.12, Chapter 40 (available at www.fs.fed.us/im/directives/fsh/1909.12/1909.12_40.doc.) The Forest Service's Peer Review Plan and Agenda is also available online at http://www.fs.fed.us/qoi/peerreview.shtml.

Alternative B Effects

If no action is taken to revise the current planning rule, all units would continue to engage private landowners, Federal agencies, State and local governments, and Tribes. Responsible officials would offer to consult with Tribes and Alaska Native corporations. All units would continue to honor the government-to-government relationship with Tribes as well. The Agency expects that the current trend of more transparent and collaborative public involvement efforts described in the Affected Environment section would continue. This trend reflects cultural changes within the Forest Service in which employees have seen the benefits of using collaboration in planning and are therefore increasingly expected to use more robust public involvement strategies. However, because these additional methods are not required, there is still expected to be variation among Forest Service units as to how collaborative public involvement would occur. Units with fewer staff resources or facing short timeframes for a planning effort might meet only the minimum requirements, and people traditionally not involved in the planning process could be overlooked. Consequently, under this alternative, the process may not identify all the social, economic, or ecological factors of importance in the plan area. Alternative B provides tremendous flexibility for collaboration but assures little consistency because it provides little direction beyond meeting the NEPA requirements for public notice and comment. While most units now go beyond the basic NEPA

requirements, the regulations require opportunities for public involvement only two times during the plan development process: (1) during scoping for development of the draft PEIS, and (2) during required public comment periods for the draft PEIS and proposed plan.

Under this alternative, approval of new land management plans and plan revisions is made by a regional forester, who is the responsible official. The responsible official is not normally a member of a community in, near, or affected by a land management plan. The local forest or grassland supervisor would supervise and be engaged in public involvement activities and would determine the significant issues and alternatives to be analyzed. Compared to the national forest or grassland supervisor, the regional forester is less likely to have a comprehensive understanding of local ecological, social, and economic concerns. As a result, the responsible official may not as fully consider or understand the unique needs of the local community. On the other hand, the regional forester is more likely to be aware of regional, Agency, and national issues, initiatives, and politics, which could result in the responsible official placing a higher emphasis on regional, Agency, and national needs rather than equally considering the needs of a local community.

Alternative C Effects

Under Alternative C all responsible officials must use a collaborative and participatory approach to land management planning (§ 219.4). All planning revision and amendment processes would include the public notice and comment required by NEPA, but the methods and timing of any additional public involvement opportunities are up to the responsible official. This alternative would have the same flexibility as Alternative B; that flexibility, however, also means the same level of inconsistency of interpretation and application as Alternative B. The national forest or grassland supervisor would be the responsible official under this alternative (§ 219.2(b)(3)). As described in Alternative A, the direct involvement of the decisionmaker would be expected to enhance the effectiveness of any collaborative process designed under this alternative.

The responsible official would have to engage other Federal agencies, State and local governments, Tribes, and other interested or affected communities, groups, or persons. However, because there is less direction on whom to engage and when, more variation among units in the extent of outreach and engagement would be expected than would occur under Alternatives A or B. In addition, there could be variation in the interpretation of what constitutes a collaborative and participatory process because there are no standards or principles to clarify the meaning. In some cases, a responsible official might use appropriate discretion to determine the timing and methods of public involvement activities, yet some stakeholders might disagree that the methods chosen constitute a collaborative process.

The responsible official would afford people who wish to challenge a decision with the same pre-decisional objection opportunity provided in Alternatives A and Modified A (§ 219 Subpart B). Therefore, resolution outcomes would be the same as described in Alternative A.

Alternative D Effects

Alternative D contains the same requirements for collaboration and transparency as Alternative A and would, therefore, have the same effects with respect to those requirements.

Alternative E Effects

Alternative E includes the provisions for collaboration from Alternative A with the addition of prescriptive methods for engaging a diverse set of interests in the planning process. In addition to those actions prescribed under Alternative A, the responsible official would also:

- Assess what collaborative resources are available for the planning process;
- Consider whether to obtain specialized assistance for the public participation process;
- Identify key stakeholders to involve;
- Use personal knowledge and connections as well as traditional outreach methods to bring all needed stakeholders to the table;
- Consult with stakeholders to determine the best methods to use in the public participation process and to identify additional stakeholders who need to be involved;
- Work with the stakeholders to identify the key areas of planning to be addressed through collaboration and establish objectives, roles, and responsibilities for all participants;
- Hold at least one public meeting during each phase of the planning process;
- Initiate a collaborative group, or engage an existing collaborative groups; and
- Develop and publicize a schedule of public participation activities to be held throughout the planning process (§ 219.4).

In some cases, these additional prescriptive methods could result in reaching a greater number of stakeholders, some of whom could add additional value to the planning process. Nevertheless, reaching more people might not lead to a greater diversity of ideas, and requiring specific efforts assumes those people want to be reached and that the required methods are always appropriate. In applying these additional prescriptive methods, a responsible official could end up engaging the public at times and at a frequency that is unnecessary, inappropriate, or unwelcome for the community or some of its members.

While a more prescribed process would be expected to meet the needs of some units, other units might find that some required steps are not relevant to or are not appropriate for their local public involvement needs. Moreover, there is a real potential for standardized activities to conflict with some specific local needs because of the recognized and documented importance of selecting public involvement methods

appropriate for the unique needs of specific situations and participants (Burby 2003; Chopyak and Levesque 2002; Chrislip 2002; Innes and Booher 2003, 2004; Johnson et al. 2003). For example, when interest groups in a particular community have extreme differences of opinion, it might be more productive to meet separately, instead of as part of a required collaborative group. In other cases, a responsible official might be aware that local stakeholders prefer to comment on a draft environmental impact statement only through writing and that, therefore, an in-person public meeting would not provide additional value during that phase of the planning process. Lastly, some units might have stakeholders who are actively engaged in numerous planning efforts of other Federal, State, or local government agencies and, thus, have less willingness or less availability to engage in prescribed Forest Service activities. In such a situation, requiring responsible officials to comply with prescribed and standardized activities is ineffective and inefficient for the Forest Service and unwelcome by those stakeholders. Were such situations to become common, responsible officials and stakeholders could become less willing to engage in subsequent collaborative processes (Ansell and Gash 2008).

Another concern about requiring a more standardized or prescribed process relates to the importance of the perceived sense of fairness regarding the process. A perceived sense of fairness about a collaborative process largely relates to a sense of ownership in the design of the process and in the formation of eventual outcomes (Ansell and Gash 2008). Expecting local participants, including Forest Service employees, to have a sense of ownership in a local process could be quite unrealistic if that process is nationally standardized (Ansell and Gash 2008). This is by definition because when a local process is determined by nationally prescribed activities, local stakeholders perceive a lack of ownership in that local process. As a result, nationally prescribed activities can mask an absence of substantive local commitment. For example, local stakeholders, including Forest Service employees, could participate, yet only go through the motions absent any real local commitment to a process in which the participants have little local ownership. This masking of an absence of local commitment to the process can lead to a false sense of support for the eventual plan and a false sense of stakeholder willingness to help achieve the goals of that plan. Taken together, these likely effects of a more prescribed approach to collaboration are likely to produce results contrary to the goal of collaboration, suggesting a contrary effect to the one desired (Williams 2006).

In this alternative, as in Alternative A, the national forest or grassland supervisor would be the responsible official under this alternative (§ 219.2(b)(3)). This alternative also includes the same pre-decisional objection provided in Alternative A (§ 219 Subpart B). Therefore, the consequences of these two features would be the same as those for Alternative A. Transparency in terms of availability of records would be the same as for Alternative A.

Coordination and Cooperation Beyond NFS Boundaries

Affected Environment

Ecological processes are not confined within NFS unit boundaries, and the many ecosystem services produced by national forests and grasslands are affected by land

management activities on adjacent private, State, local, and other Federal Government lands. National Forest System lands are also directly affected by development pressures at their boundaries. More than 21 million acres of rural lands located within 10 miles of national forests and grasslands are projected to undergo increases in housing development by 2030 (Stein et al. 2007).

There is a level of required coordination with local, State, and Federal agencies and Tribes that is independent of the planning rule regulations. Under Endangered Species Act regulations, the Agency must consult with the U.S. Fish and Wildlife Service (FWS) and National Oceanic and Atmospheric Administration (NOAA) Fisheries on any actions that may affect threatened or endangered species (50 CFR 402). Under CEQ NEPA regulations, the Forest Service invites any Federal agency with specific expertise or jurisdiction on a Forest Service action to become a cooperating agency in the environmental analysis (40 CFR 1501.6); Section 6 of NFMA requires land management planning to be "coordinated with the land and resource management planning processes of State and local governments and other Federal agencies" (16 U.S.C. 1604 (a)). State, local, or tribal governments may request, or be invited, to be a cooperating agency as well.

The Federal Land Policy and Management Act of 1976 (43 U.S.C. 1712) provides that:

> In the development and revision of land use plans, the Secretary of Agriculture shall coordinate land use plans for lands in the National Forest System with the land use planning and management programs of and for Indian Tribes by, among other things, considering the policies of approved tribal land resource management programs.

The responsible official would also follow Agency procedures for consultation with American Indian and Alaska Native tribal governments as described in Forest Service Manual 1563 (available at http://www.fs.fed.us/im/directives/fsm/1500/1562-1566.11.doc). Under these procedures, the responsible official would coordinate land management planning with tribal land and resource management plans and actions to promote the health of ecosystems. The responsible official would therefore provide opportunities for tribal input under all of the alternatives; the specifics of what would be required vary by alternative.

Current rule procedures include requirements for coordination of Forest Service planning with other Federal planning efforts (§ 219.7). Under current procedures, the responsible official:

- Coordinates planning with related planning efforts of Federal agencies, State and local governments, and Tribes;
- Provides notice of plan development and revision to these entities;
- Conducts and documents a review of other agency plans and land use policies;
- Meets with appropriate representatives of these governments and agencies and seeks input from them; and

- Monitors and evaluates the effects of NFS management on adjacent land, resources, and communities, as well as effects on NFS lands from activities on nearby lands.

Based on other current planning requirements that recognize lands and resources beyond NFS borders, responsible officials:

- Coordinate with owners of land intermingled with NFS lands or dependent for access on NFS lands. This coordination is documented in an environmental impact statement for the plan (§ 219.6(k)).
- Coordinate with State fish and wildlife agencies to coordinate planning for wildlife (§ 219.19(a)(3)).
- Identify the supply of developed recreational facilities in the area of national forest influence (219.21(b).
- Coordinate the formulation and evaluation of alternatives with proposed recreation activities of local and State land use or outdoor recreation plans, particularly State comprehensive outdoor recreation plans and recreation opportunities available on other lands (§ 219.21(e)).

In addition to meeting the requirements for cooperating with other agencies and State and local governments, many Forest Service units participate in landscape-scale initiatives that cross multiple ownership boundaries. This reflects a growing recognition by the Agency of both the value and need for landscape-level projects and programs. Examples include the Collaborative Forest Landscape Restoration Program (http://www.fs.fed.us/restoration) and the Four Forests Restoration Initiative in Arizona (http://fs.usda.gov/goto/kaibab/4fri). Further examples of this type of coordination are described in a recent Forest Service publication on partnerships to conserve open space (Harper and Crow 2006). These types of partnerships, both within the land management planning process and in other Agency efforts, are increasingly becoming a standard approach to NFS business and are expected to continue in the future.

There have also been major interagency assessments and in some cases plans or plan amendments establishing coordinated or common management among multiple NFS units, often with participation of other Federal agencies. Examples of these include the Northwest Forest Plan (USDA Forest Service and USDI Bureau of Land Management 1994); the Interior Columbia Basin Assessment (Quigley et al. 1996); the Southern Forest Resource Assessment (Wear and Greis 2002); and the Northern Rockies Lynx Management Direction (USDA Forest Service 2007d). Emerging policies that focus on management of the wildland-urban interface between NFS lands and private lands (Laverty and Williams 2000) depend on coordination among NFS units and adjacent property owners and governmental jurisdictions. Some monitoring and evaluation efforts (e.g., the Northwest Forest Plan Monitoring Report (Haynes et al. 2006)) are collaborative multi-agency efforts that monitor lands and waters of multiple agencies, and to some extent private lands, to develop an understanding for the context of Federal land management. Communication is increasing among NFS land managers and Tribes, other Federal agencies, and State and local governments. To some extent, NFS employees have also participated in assisting other planning jurisdictions in their planning.

Since all plans have been developed or revised under the 1982 procedures, it is evident that the trends toward increased coordination across boundaries have exceeded the requirements of the current planning rule. This trend resulted from an increased recognition that NFS land management must be considered in the broader landscape and that only this kind of approach can address problems such as maintaining watershed conditions, conserving wide-ranging species, and providing for effective transportation and infrastructure on and off NFS lands. These trends are expected to continue, but there is no standard or required approach for such coordination or for evaluating the all-lands context of any issue. Under all alternatives, responsible officials at the district, unit, regional, or national scales are expected to continue to address these issues based on the specific characteristics of the issue under consideration.

Under each of the alternatives, the planning process would be subject to NEPA, the Endangered Species Act (ESA), and other laws and regulations for coordination and cooperation with other Federal agencies and State, local, and tribal governments. Units would work with the Environmental Protection Agency as a reviewer of the environmental impact statement for the proposed and final plans, and units would consult with FWS and NOAA Fisheries on the parts of the plan that deal with threatened or endangered species.

Volunteers, partnerships, and conservation education are important components of coordination and cooperation beyond NFS boundaries. The USDA Forest Service Strategic Plan (USDA Forest Service 2007d) includes many goals for conservation education, partnerships, and volunteers; for example:

- Promote conservation education to increase environmental literacy through partnerships with groups that benefit and educate urban populations.
- Engage partners and educators in the development, distribution, and use of high-quality conservation education materials and interpretive programs.
- Use private, nongovernmental, and interagency partnerships to accomplish collaborative community recreation/tourism plans.
- Build connections between rural and urban communities through partnerships among the Forest Service, other Federal agencies, and State and local organizations.
- Develop partnerships with nontraditional partners to engage urban and underserved audiences.
- Work with partners to expand capability to participate in conservation through stewardship, research, and intergovernmental coordination.
- Work with partner volunteers, nongovernmental organizations, other agencies, and the private sector to provide additional recreational benefits without unacceptable resource impacts.
- Support conservation education, community “greening” efforts, and programs that provide youth with opportunities to volunteer.

Conservation education programs are delivered internally and externally at every level of the Forest Service through the State and Private Forestry, National Forest System, and Research and Development branches. Conservation Education Program staff members work with many internal and external partners to coordinate, develop, and deliver educational programs and materials. These partners include in-house programs plus State, tribal, and local agencies; nonprofit organizations; and the interagency Service First aligned services partnership between the Bureau of Land Management and the Forest Service, among many others.

In 2009 alone, the Forest Service entered into 8,931 grants and agreements with partners for a total value contributions (Forest Service and partners combined) of $1.48 billion dollars.

Data from the Forest Service centralized reporting system show that nationwide in 2007, there were 2,618,163 volunteer hours recorded across all categories. These volunteer hours provide services that would be valued at more than $55 million at the accepted independent sector rate. Although there is variation across the Forest Service regions—with roughly 200,000 to 600,000 hours per region—all regions report substantial volunteer programs. The vast majority of these are in the recreation and heritage resource program areas (Absher 2008).

The need for planning to address issues such as threatened and endangered species, water quality, fire management, and large-scale infrastructure needs (such as road and trail networks) means that land management planning would involve at least some consideration of cross-boundary issues and topics that extend beyond the plan area. The differences among alternatives revolve around specific requirements for how and when to engage other Federal, State, local, and tribal governments in the planning process and how to incorporate and consider landscape-level information.

Alternative A Effects

Alternative A contains requirements for collaboration with Tribes, States, local governments, other Federal agencies, and private landowners similar to Alternative B (the no action alternative). It has provisions essentially identical to Alternative B for coordination of planning efforts with other government agencies for a new plan or plan revision. It also has explicit language for consultation with federally recognized Tribes (§ 219.4(b)).

Under the additional provisions of Alternative A, the responsible official would encourage States, counties, and other local and tribal governments to participate in the planning process as cooperating agencies where appropriate and would request information on native knowledge, land ethics, cultural issues, and sacred and culturally significant sites (§ 219.4(a). The responsible official also would provide opportunities for other agencies and governments to engage early in the process, inviting them to participate in the assessment process and the development of the proposed plan, plan amendment, or plan revision, instead of waiting until the proposed plan is issued for comment.

Land management planning under Alternative A would go beyond the requirements of Alternative B by considering all lands and looking across boundaries throughout the assessment, plan development/revision, and monitoring phases of the planning process (§ 219.5).

During the assessment phase, relevant ecological, economic, and social conditions, trends, and sustainability within the context of the broader landscape would be considered (§ 219.6). The responsible official would:

- Identify and consider relevant information contained in governmental or non-governmental assessments, plans, monitoring evaluation reports, and studies, including relevant neighboring land management plans (§ 219.6(b)(2)).
- Identify the distinctive roles and contributions of the unit within the context of the broader landscape, considering the roles of the unit in providing multiple uses, including ecosystem services, from the NFS lands to the local area, region, and Nation (§ 219.6(b)(3)).

In developing a proposed plan or plan revision, the responsible official would:

- Include a description of the unit's distinctive roles and contributions within the broader landscape in the plan (§ 219.7(e)(1)(ii));
- Take into account landscape-scale integration of terrestrial and aquatic ecosystems (§ 219.8(a)(1)(i));
- Take into account social, cultural, and economic conditions relevant to the area influenced by the plan, and the distinctive roles and contributions of the unit within the broader landscape (§ 219.8(b)(1)); and
- Take into account multiple uses, including ecosystem services, that contribute to local, regional, and national economies in a sustainable manner, and cultural and historic resources and uses (§ 219.8).

During the monitoring phase the responsible official would:

- Coordinate and integrate with other relevant broad-scale monitoring strategies (§ 219.12(a)(3));
- Take into account opportunities to design and carry out multi-party monitoring with other Forest Service units; Federal, State, or local government agencies; scientists; partners; members of the public; and federally recognized Indian Tribes and Alaska Native corporations (§ 219.12(c)(5)); and
- Monitor progress toward fulfilling the unit's distinctive roles and contributions to ecologic, social, and economic conditions of the local area, region, and Nation (§ 219.12(a)(5)(vii)).

These requirements for coordination and cooperation would involve more time than is currently spent in the planning framework to manage appropriate participation, recognition, and evaluation of the interests of other governments and agencies. The Agency expects increased consideration of conditions and trends outside the plan area

boundary as part of the assessment phase of the proposed planning framework. Greater formalized monitoring and evaluation of conditions and trends in the broader landscape should also result during the monitoring phase of the proposed planning framework. The increased communication should make other governments aware of the abilities and limitations of the planning unit, and the planning unit should be similarly aware of the abilities and limitations of other jurisdictions.

These requirements would be expected to provide opportunities for consideration of issues in an all-lands context and the needs of other governments and agencies. By working with other agencies and identifying the unique role of the unit, a unit would be able to focus plan development and implementation on the issues where the unit can have the greatest contribution. It is expected that units would leverage their resources with those of other agencies to efficiently implement the vision of their plans.

All plans would identify the roles and contribution of the planning unit in the broader landscape (§ 219.2(b)(1)); currently not all plans do this. While some planning efforts engage in this level of coordination and see corresponding results, it is not practiced system-wide. Land management planning would exhibit more consistency across units in the type and timing of coordination efforts than currently experienced.

While Alternative A does not include specific requirements for plan components for education, partnerships, and volunteers, it does allow them as strategies under optional content in the plan (§ 219.7(e)(2)). Coordination activities identified under the Affected Environment section are expected to continue or to increase under this alternative.

Modified Alternative A Effects

The effects of Modified Alternative A are the same as for Alternative A except:

The identification of the distinctive roles and contributions of the unit within the context of the broader landscape would occur in plan development or revision rather in the assessment phase. This change is in response to those who believed this identification of distinctive roles and contributions was a decision and should be subject to NEPA. The different timing of identification of distinctive roles and contributions of the unit does not lead to different effects for the purposes of this PEIS, it merely alters the timing for when this requirement is met, and is consistent with NEPA.

Other modifications to this alternative related to coordination and cooperation either improve organization and/or clarify the intent of Alternative A and do not change the effects.

Alternative B Effects

Alternative B includes requirements for coordination of Forest Service planning with other Federal planning efforts (§ 219.7). Under these current procedures, the responsible official would continue to coordinate planning activities with the planning efforts of other Federal agencies, State and local governments, and Indian Tribes; and coordinate with adjacent private land owners. The responsible official would notify Federal agencies, State and local governments, and Tribes simultaneously with publication of a notice of

intent to prepare an environmental impact statement for a new plan or plan revision. The responsible official would also meet with agency and government representatives to develop procedures for coordination and hold additional meetings prior to recommending the preferred alternative. The responsible official would review the relevant planning and land use policies of these agencies and governments, identify interrelated impacts of these plans and policies, and consider alternatives for the resolution of any conflicts. These procedures for cooperating across all lands in the planning process would be consistently applied across the NFS.

These requirements provide for consultation and coordination but do not require detailed analysis or evaluation of conditions and trends outside of the NFS boundary apart from those previously mentioned.

If no action is taken to revise the current planning rule, it is expected that the procedures, conditions, and trends described in the Affected Environment section would continue. The general trend in the planning process for more coordination across all lands would continue, but there would be considerable variation across units in the amount of coordination and what specific plan content would result.

Alternative B does not include direction specifically related to partnerships, volunteers, or conservation education; however, activities as described under Affected Environment are expected to continue.

Alternative C Effects

There is no requirement in Alternative C to identify the role and contribution of the planning area to the broader landscape, no requirement to specifically evaluate and document a review of existing plans or policies related to the surrounding area, and no requirement for an evaluation of the conditions and trends that surround the planning unit. Alternative C does require the responsible official to use a collaborative and participatory approach to land management planning that must engage the skills of other Federal agencies; federally recognized Indian Tribes; Alaska Native corporations; State or local governments; or other interested or affected communities, groups, or persons (§ 219.4). However, how to do this is left to the discretion of the responsible official.

Although Alternative C does not include as many specific requirements as Alternative B for consideration of lands outside of the boundaries of NFS lands, the general trend for more interagency coordination in the planning process is expected to continue under this alternative. General Forest Service policies and practices promote this type of coordination and it has become a part of Agency culture in many places. Absent specific requirements, this alternative is not expected to lead to formal assessment or monitoring of lands outside the NFS boundaries. Similarly, coordination would be expected to occur but would be inconsistent across the NFS.

As a consequence of inconsistent coordination across the NFS, not all plans would be expected to identify the unit's unique role or focus plan development and implementation on the issues where the unit might have the greatest impact. Where coordination is lacking, it is not expected that units would leverage resources to efficiently implement the vision of the plans.

Alternative C does not include direction specifically related to partnerships, volunteers, or conservation education; however, activities as described under Affected Environment are expected to continue.

Alternative D Effects

Alternative D is focused on several aspects related to watersheds and species diversity; otherwise, it is similar to Alternative A. It does require certain processes and specific plan components that would also involve greater coordination at a landscape or watershed scale than would be done under Alternatives A or B. Some of these requirements specifically address coordination among multiple governments and others specifically address consideration of all lands. Unique to this alternative:

- Plan development, assessment, and monitoring would be coordinated across multiple planning units (§ 219.4(c)).
- Planning would be coordinated to the maximum extent at the landscape level with all other governments and organizations engaged in species conservation to:
- Maintain viable populations,
- Develop strategies to address impacts of global climate change on plan and animal communities,
- Establish linkages between habitats and discrete populations, and
- Develop joint resource management plans and other efforts (§ 219.4(c)).
- Joint efforts in support of maintaining viable populations across jurisdictional boundaries would be conducted (§ 219.4(c)).
- Maximum opportunities for consultation with government agencies and private landowners would be provided (§ 219.4(c)).
- Planning would be coordinated with relevant conservation plans, including State comprehensive wildlife strategies and other State conservation strategies, national fish habitat partnerships, North American Wetland Conservation Act joint ventures, and the Federal-State private partnership known as Partners in Flight (§ 219.4(c)).
- Plans would include components for key watersheds (identified in assessment) and spatial connectivity between watersheds. Plans would include standards and guidelines for:
    - Connectivity of key watersheds across the planning unit;
    - Road densities in key watersheds for specified watershed objectives;
    - Protection, maintenance, and restoration of a natural range of variability in the sediment regime;

- Road removal and remediation in key watersheds and riparian conservation areas as the top restoration priority; and
- Achieving the minimum necessary road system (§ 219.8(a)).

This alternative would accelerate the existing trend toward more landscape-level approaches for plant and animal diversity. This would be expected to lead to a more consistent approach to issues of ecological conditions and species viability across the landscape. Because of the time and resources needed to meet the coordination requirements for species viability, there could be less time and resources available to spend on other resources of concern.

Under this alternative, specific plan components for restoring spatial connectivity within and between watersheds, removal and remediation of roads from key watersheds, and restoration of a natural range of variability in the sediment regime would be included in plans. While these components would be limited to management of NFS lands, interests of other landowners would have to be clearly taken into account to develop these plan components. For example, any standards to limit road densities to achieve aquatic restoration would have to recognize roads of other jurisdictions and those needed by other jurisdictions, including private property owners. Similarly, it is not expected that any objective to restore a natural range of variability in a sediment regime would succeed unless other ownerships and jurisdictions within a watershed have similar goals.

This alternative would not add to the extent of coordination with other agencies (i.e., the same agencies would be involved), but it would add substantially more cooperation and coordination with these agencies than would occur under Alternative A or Alternative B. In the above road density and sediment regime examples, development of these plan components would add elements of coordination for inventory and assessments of roads and waterways that might not be needed under Alternatives A or B. Coordination would necessarily continue into project proposals and implementation to achieve mutual agency objectives to establish a minimum road system that spans jurisdictions and synergistic watershed improvement projects.

Alternative D does not include direction specifically related to partnerships, volunteers, or conservation education; however, activities as described under Affected Environment are expected to continue.

Alternative E Effects

This alternative is the same as Alternative A with additional detailed requirements for public participation and collaboration; conservation education, volunteer, and partnership programs; and detailed monitoring program requirements that include identification of signal points to be used by the responsible official to determine the need for changes in a plan (§ 219.12). Under this alternative, several items related to lands outside NFS boundaries would be monitored. These items would include status and trend of goods and services that contribute to sustaining economic systems in the plan area, status of threatened and endangered species across the landscape, and risks and uncertainties from climate change where species might need to migrate or shift to locations favorable to continued viability. Meeting these requirements would necessitate coordination and

cooperation across NFS boundaries to establish consistent monitoring protocols and to share data. However, the cooperation and coordination requirements in Alternative E are the same as those in Alternative A. Consequently, coordination and cooperation beyond NFS boundaries would be the same as in Alternative A.

Under this alternative all plans would include plan components for conservation education, volunteer, and partnership programs. As described in the Affected Environment section, these are already very active and widely used programs to achieve resource management objectives. Plan components specifically related to conservation education, volunteers, and partnerships would not be expected to result in any change in recognition or in levels of activity of these programs.

CUMULATIVE EFFECTS

The Council on Environmental Quality (CEQ) regulations for implementing the procedural provisions of NEPA define a cumulative effect as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what Agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR § 1508.7). CEQ has also provided guidance in Considering Cumulative Effects under the National Environmental Policy Act (1997). This publication can be found at http://ceq.hss.doe.gov/publications/cumulative_effects.html/.

For cumulative impacts to accrue there must first be an impact from the action under review that can then be added to the impacts of other past, present, or reasonably foreseeable future actions that affect the same resource. The proposed planning rule and alternatives would guide development, revision, and amendment of land management plans across the NFS. Plans in turn will guide the management of a plan area.

The affected environment for the planning rule, as noted previously, constitutes 193 million acres of NFS lands across 127 NFS planning units and 44 states. Attempting to describe the cumulative effects of each and every past, present, and reasonably foreseeable Forest Service project for the entirety of these lands is neither possible nor informative at the programmatic level. As noted in CEQ's guidance memorandum of June 24, 2005, the effects of past actions can generally be captured by a description of the affected environment, which is detailed in the preceding sections of this chapter (Council on Environmental Quality 2005). Examination of the effect of the proposed planning rule on pending or reasonably foreseeable project-level decisions would be impossible at least until individual unit plans are developed and the possible effect of those plans on pending or future projects could potentially be forecast, other than to say that future plans will comply with the rule and future projects will be consistent with the plans. It is possible, however, at this point, to look at potential effects that a new planning rule might have on broader Agency actions that are at the same scale as a new planning rule.

Cumulative effects have also been discussed throughout Chapter 3, and other areas of the PEIS. The discussion of effects for many of the alternatives explores the effects of the alternative in combination with other ongoing initiatives, strategies, policies, laws, etc. Examples of this include discussion of the effects of each alternative in combination with

items such as the Endangered Species Act, Travel Management Rule, Open Government Directive, National Roadmap and Performance Scorecard, and other Agency strategies and policies.

The Forest Service and Department of Agriculture have a number of ongoing or recently finalized rulemaking and policy efforts that alone or in combination with the planning rule might affect management of NFS lands and resources. As these rules and policies are finalized, the Agency can integrate or clarify certain provisions within each rule or policy to ensure consistency, clarity, and effectiveness with other ongoing initiatives. The relationships of these efforts to the proposed and alternative planning rules are discussed below.

Roadless Rules

In determining the cumulative effects, the Agency considered the current status of the various roadless rules:

- The Idaho Roadless Rule, issued in 2008 (36 CFR Part 294 subpart C);
- The Roadless Area Conservation Rule, issued in 2001 (36 CFR Part 294 subpart B); and
- The proposed Colorado Roadless Rule (http://roadless.fs.fed.us).

The Agency also considered current roadless area guidance (USDA 2010b and USDA Forest Service 2010m) and pending legislation that would require management of roadless areas along the lines of the Roadless Area Conservation Rule. The potential for combined effects of the alternatives in this programmatic environmental impact statement were considered with the anticipated effects of the Roadless Area Conservation Rule, as well as all the alternatives considered in that rule's environmental impact statement, the Idaho Roadless Rule, the Colorado State rulemaking petition and preliminary alternatives, and introduced legislation (H.R. 1975, H.R. 2516, and S.1478) (see Appendix N).

On October 21, 2011, the 10th Circuit Court of Appeals overturned the Wyoming District Court decision enjoining the RACR nation-wide (*WY v. USDA*). The change in the litigation status of the RACR with the 10th Circuit Court's decision does not substantively change the conclusions about cumulative environmental effects for any alternative in this chapter. The 9th Circuit Court of Appeals had previously upheld the RACR throughout its Circuit and New Mexico. Since the area covered by the 9th Circuit decision includes nearly 70% of the lands in the National Forest System, the 10th Circuit decision upholding the RACR for the remaining NFS lands does not materially change the cumulative effects analysis for the proposed action or alternatives.

In all cases, the effects of provisions of any planning rule alternative and these various roadless rules and bills have independent effects; therefore, the effects are not cumulative. The alternatives in this programmatic environmental impact statement would give the responsible official discretion to select management direction for inventoried roadless areas and would not affect the ability to comply with constraints of any existing or future roadless rule or statute.

Strategic Plans and Other Agency Goals

The Department of Agriculture Strategic Plan FY 2010–2015 (USDA 2010a) includes a goal to ensure national forests and grasslands are conserved, restored, and made more resilient to climate change, while enhancing water resources.

The USDA Forest Service Strategic Plan: FY 2007–2012 (USDA Forest Service. 2007d) supports the Department of Agriculture plan and contains seven broad strategic goals for the Agency:

1. Restore, sustain, and enhance the Nation's forests and grasslands.
2. Provide and sustain benefits to the American people.
3. Conserve open space.
4. Sustain and enhance outdoor recreation opportunities.
5. Maintain basic management capabilities of the Forest Service.
6. Engage urban America with Forest Service programs.
7. Provide science-based applications and tools for sustainable natural resources management.

The strategic plan recognizes seven factors beyond the control of the Forest Service that could affect progress toward accomplishing these long-term goals and objectives. They include:

1. Extreme weather, climate fluctuations, and environmental change beyond the natural range of forest and grassland variability that affect ecological productivity and resilience;
2. Legal or regulatory constraints or changes that affect management activities, available options, or program resources;
3. Incomplete, untimely, or conflicting information that reduces managerial efficiency and effectiveness;
4. Independent actions by external groups or individuals, including landowners, that affect forest and grassland management or Forest Service objectives;
5. Demographic shifts or changes in stakeholder perceptions that result in unanticipated shifts in expectations;
6. Unpredictable economic fluctuations that change market conditions and human behaviors; and
7. International crises or homeland security issues that alter domestic program accomplishments or public needs.

The strategic plan provides national-level direction that guides the Forest Service in delivering its mission. The strategic plan establishes goals, objectives, performance measures, and strategies for management of the NFS, as well as the other Forest Service mission areas: Research and Development, State and Private Forestry, and International Programs. The planning rule alternatives complement the strategic plan by providing a

framework for an individual Forest Service unit to develop a land management plan that will guide the management of its natural resources in accord with the strategic plan. The proposed rule and alternatives would provide a means for each NFS unit to organize and apply strategic plan direction to local ecological, social, and economic conditions. The planning rule alternatives are consistent with the strategic plan's goals and objectives. Requirements in Alternatives A, D, and E are more reflective of the strategic plan goals, particularly Goals 1, 2, and 4 (above) than are Alternatives B and C. However, none of the alternatives would expand or diminish the strategic plan direction that guides the Forest Service in delivering its mission.

NEPA Procedures

Forest Service procedures for implementing the National Environmental Policy Act (NEPA) at 36 CFR 220 (73 FR 43084) identify classes of actions normally requiring preparation of an environmental impact statement (36 CFR 220.5(a)). Some of the alternatives under consideration in this programmatic environmental impact statement include a requirement to prepare an environmental impact statement for approval of new and revised land management plans. Should an alternative be selected that requires preparation of an environmental impact statement, the provision at § 220.5(a) would require a conforming amendment to add this additional class of actions. Including § 220.5 (a) that the development or amendment of land management plan as a class of actions normally requiring preparation of an environmental impact statement would be simply a restatement of the planning rule requirement, and would not be an additional requirement. Therefore, the planning rule and the NEPA procedures rule together would not have a cumulative effect. Even were § 220.5(a) not amended to identify this class of actions as normally requiring an environmental impact statement, the planning rule requirement would still apply, and there would not be cumulative effects from the two rules.

Multiple Plan Amendments and Assessments

There are some land management plan amendments that were developed and approved to apply to multiple national forests and grasslands. Some of these plan amendments were developed and implemented across multiple agency jurisdictions, such as the Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl, commonly called the Northwest Forest Plan (USDA Forest Service and USDI Bureau of Land Management 1994) and the designation of West-wide Energy Corridors, which amended 39 Forest Service land management plans in 10 States as well as the land use plans on public lands managed by the Bureau of Land Management in 11 States (U.S. Department of Energy and U.S. Department of Interior, BLM 2008). Others, such as the Sierra Forest Plan Amendment, commonly called the Sierra Nevada Framework, apply to only NFS land management plans, amending 11 land management plans (USDA Forest Service 2010l). The effects of these actions are not cumulative with effects of the planning rule alternatives as they do not change the outcomes of the rule.

Additionally, there have been regional assessments—such as the Southern Appalachian Assessment (Wear and Greis 2002) and the Interior Columbia Basin Assessment (Quigley et al. 1996)—that do not, by themselves, amend or revise land management

plans. These documents provide large-scale information for use during the development, amendment, or revision of individual land management plans but do not have any effects. Regional assessments provide valuable information to responsible officials for revision and amending land management plans. Assessments do not approve or prohibit projects and activities and have no effects on the human environment. Consequently, there can be no cumulative effects from regional assessments that inform decisions concerning the substantive content of land management plans and the requirements of a planning rule.

Transition to a New Planning Rule

If an action alternative is selected (i.e., any alternative except Alternative B), there would be a period of transition of up to 15 years, during which time some plans would not yet be revised under the new planning rule. The effect of the Agency's current and past use of the 1982 planning rule procedures would endure in the framework and content of existing land management plans until they are revised under a new rule. The effect of a new rule would be reflected in the process for development and revision of plans along with plan format and content. The cumulative effect of a new rule with the effect of the current rule would be that the consistency in the planning process and plan content across the NFS promised by the new rule would not be achieved for the period of time until all plans have been revised under a new rule. Since there is a diversity of resources and uses across the NFS and each unit has its own unit-specific plan, there are already differences among plans. The adoption of a new planning rule would likely result in plans that vary in their appearance more so than they have in the past, at least until all plans have been revised under the same rule.

Other Land Management Agencies' Planning Direction

Many NFS units are located adjacent to or near lands managed by other land management agencies, such as national parks managed by the National Park Service, public lands managed by the Bureau of Land Management, State lands, and tribal lands. With such a diversity of agencies and agency missions, there exists potential for cumulative effects from plans—both beneficial and adverse. For example, a plan to restore habitat connectivity for a particular species across a series of State lands would be far more successful if it were coordinated with a similar plan objective on adjacent NFS lands. Conversely, a lack of coordinated planning on the NFS land might further fragment habitat or at least limit success of the State plan.

While the cumulative effects of future land management planning and subsequent site-specific project approval decisions cannot be known at this time, a planning rule can provide for the analysis of those cumulative effects, when they can be anticipated, during the plan amendment or plan revision process. Accordingly, all alternatives would require coordination of planning efforts with related planning efforts of other Federal agencies, State and local governments, and Indian tribes. The Forest Service has maintained this coordination requirement in its planning rule since 1979 and will continue this requirement even if no rule revision is made. None of the alternatives would change this current direction and consequently there would be no differences in effect among the alternatives. The requirement is at § 219.4 in all but Alternative B, which contains the same direction at § 219.7. With this provision, cumulative effects of land management

plan direction with that of other land management agencies will be analyzed where the effects can be meaningfully evaluated, during development and revision of plans for each NFS unit.

Collaboration

The proposed rule and other action alternatives seek to improve plans and expedite the planning process by expanding opportunities for the public to participate in plan development. The 1982 rule invited public input to the planning process through oral and written comments on the NOI and NEPA procedures related to the environmental impact statement for the plan. The need to more effectively involve the public in the planning process was one of the findings of the 1990 Critique of Land Management Planning Volume 5 (http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5172345.pdf).

Collaboration under all action alternatives would be cumulative to numerous collaborative efforts presently competing for people's time. Project planning on national forests and grasslands can be a matter of such interest that public meetings and field trips have become common tools of project development. As government planning becomes more open and participatory at all levels, people are being given more opportunities to participate and thus having more demands on what many Americans already consider their most precious resource—their personal time. Participating in the revision of land management plans under any of the action alternatives might call for attendance at round-tables, shared learning sessions, or fieldtrips exploring alternative approaches to land management. Some people will participate to share their local knowledge and expertise with the responsible officials. Some will feel compelled to attend out of concern that the discussions by various proponents will not correctly articulate their concerns. Others will be unable to participate because of professional or family obligations. While the opportunity to provide written comments at various points in the process will still exist, the emphasis on collaboration might elevate the concern that written comments are an ineffective means of influencing the planning process.

Short-term Uses and Long-term Productivity

NEPA requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). As declared by Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which humans and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

All the alternatives would set out procedural requirements for development, revision, and amendment of land management plans, and would set out some requirements regarding plan content. However, these rules neither authorize nor prohibit short-term uses of NFS lands.

Pursuant to the Forest and Rangeland Renewable Resources Planning Act of 1974 as amended by NFMA, the proposed action and alternatives each adheres to the principles

of the Multiple-Use Sustained-Yield Act of 1960 in setting out process and content requirements for the development and revision of land and resource management plans. Accordingly, plans prepared under any of the alternatives would provide guidance for a sustainable flow of goods and services while maintaining the productivity of the land.

Unavoidable Adverse Effects

All the planning rule alternatives would set out procedural requirements whereby NFS land management plans are developed, revised, and amended. They would establish administrative procedures for development, revision, and amendment of land management plans and would set out some requirements regarding plan content. These rules would not dictate the activities that would occur or not occur on administrative units of the NFS. Accordingly, the alternatives do not have energy requirements or energy conservation potential, and they do not have natural or depletable resource requirements. As previously discussed, each alternative has merits and trade-offs related to the issues. However, none of the alternatives would result in any unavoidable adverse effects on the human environment.

Irreversible and Irretrievable Commitments of Resources

An *irreversible* commitment of resources describes the loss of future options with respect to those resources. It applies primarily to the effects of use of nonrenewable resources, such as minerals or cultural resources, or to those factors, such as soil productivity that are renewable only over long periods of time. An *irretrievable* commitment of resources applies to the loss of production, harvest, or use of natural resources. For example, some or all of the timber production from an area is lost irretrievably while an area is serving as a winter sports site. The production lost is irretrievable, but the action is not irreversible because if the use changes, it is possible to resume timber production.

Neither the proposed action nor any of the alternatives would itself be an irreversible or irretrievable commitment of resources, nor would it cause such commitments. Rather, the proposed planning rule and alternative planning rules merely describe the process the Forest Service would use to make decisions for development, revision, and amendment of national forest and grassland plans and the structure of those plans, including setting out some requirements for plan content. Any commitments of resources would take place when projects or activities are proposed, their effects are analyzed in the appropriate NEPA process, consistency with the applicable land management plan is determined, and the project or activity is authorized.