CHAPTER 3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

CONTEXT

Consideration of the effects of the proposed rule and 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 proposed rule and alternatives. In addition, the necessity of staged decisionmaking, from rule, to plans, to projects and activities, affects the extent to which effects of the proposed rule and 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 policy.

At the top of this hierarchy, after the United States Constitution, are the relevant statutes. There is no discretion in compliance with the law; the requirements are mandatory and must be followed. Some of the principle 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 and the Water Quality Act of 1987 and other laws (33 U.S.C. 1251 et seq., 1323 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 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. For example, compliance with the Endangered Species Act, Section 7 consultation requirements is guided by regulation at 50 CFR Part 402. Similarly, 36 CFR Part 800 guides compliance with the section 106 requirements of the National Historic Preservation Act. Regulations must comply with law and do not supersede laws. While Title 36 CFR Parts 200 to 299 contain regulations specific to the Forest Service, the Agency must follow not only its own regulations, but other applicable regulations, such as those previously mentioned.

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 would be 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 since it is not currently among the listed 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 CFRs are 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 Agency policy. Agency policy is specified 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 policy must follow laws and regulations. Compliance with Agency policy is a constant among all of the alternatives.

Similar to a proposed planning rule, 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 directives of substantial public interest (§ 216.6(a)).

Land management plans developed for each unit of the NFS are found at the bottom of this hierarchy of direction. 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. These plans reflect laws, regulations, and Agency policies. A plan does not authorize projects or activities, nor does it commit the Forest Service to take action; however, a plan can constrain the Agency from authorizing or carrying out actions. The NFMA requires that plans and permits, contracts, and other instruments for the use and occupancy of National Forest System lands be consistent with the applicable land management plan (16 U.S.C. 1604(i)).

Staged Decisionmaking and Environmental Analysis

Adoption of a planning rule is only the first step in a series of decisions before any action is taken that directly affects the environment. A planning rule sets out requirements for development, revision, and amendment of land management plans. This document discloses the results of a programmatic environmental analysis concerning anticipated effects of a proposed planning rule and alternatives thereto.

A planning rule would set out certain requirements and constraints for land management planning. Each land management plan, in turn, sets out a framework and sideboards to guide all natural resource management activities on a NFS unit. Land management plans also undergo programmatic environmental analysis with effects being considered in a more local context. Such analysis includes identifying the trade-offs of managing for various mixes of multiple uses on a particular unit. A plan will typically influence the choice and design of future proposals for projects and activities in a plan area. As a planning rule establishes requirements and constraints for land management planning, land management plans establish further constraints upon the decision space for on-the-ground management decisions. A third decisionmaking step, authorization of on-the-ground activities, must be made in compliance with environmental laws and requires yet another environmental analysis. Site-specific effects are analyzed at this level of decision making. Decisions in this third step must be consistent with the applicable land management plan.

Environmental analysis and disclosure pursuant to NEPA, implementing regulations at 40 CFR 1500, and Forest Service NEPA procedures at 36 CFR 220 occurs at all three of the above decision making steps. Each stage (rule, plan, and project) represents a narrowing of decision space and increasing specificity regarding the effects of those decisions.

The Council on Environmental Quality regulations recognize this staged approach to decisionmaking in providing for "tiering." Tiering 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. This allows subsequent analyses to concentrate solely on the issues specific to those narrower statements. 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 decision making 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).

Approval of a planning rule to guide development, revision, and amendment of land management plans is a broad policy decision. Accordingly, impacts addressed in this programmatic environmental impact statement reflect issues concerning effects over a broad geographic and time horizon. The depth and detail of impact analysis is necessarily broad and general because a planning rule is two steps removed from site-specific projects and activities. Site-specific effects can only be predicted with any certainty when site-specific actions are proposed. Effects of a rule to guide development, revision, and amendment of land management plans include the general contents of resulting plans such as requiring inclusion of certain plan components (e.g., desired conditions, objectives, standards, and guidelines). Effects of such a rule would also include the procedures to be followed for the development, revision, and amendment of plans (e.g., collaborative development of assessments, proposed plans, and plan monitoring programs). Where there is a sufficient cause-effect relationship, the effects analysis of a planning rule might extend to general discussions of potential effects of plan implementation on the human environment.

In a case concerning a previous planning rule, the district court for the Northern District of California, quoting the Ninth Circuit Court of Appeals, held that "an EIS for a programmatic plan must provide sufficient detail to foster informed decisionmaking, but that site-specific impacts need not be fully evaluated until a critical decision has been made to act on site development." (*Citizens for Better Forestry v. United States Dep't of Agriculture*, 481 F. Supp. 2d 1059, 1086, (ND. Cal. 2007)) Another court found that a programmatic EIS reflects the broad environmental consequences attendant upon a wide-ranging federal program by focusing on "broad issues" relevant to the program while a subsequent site-specific EIS will address more particularized considerations (*Nevada v. Dept. of Energy*, 457 F.3d 78, 92 (D.C. Cir. 2006)).

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. The programmatic effects of the approval of a land management plan include the mix of goods and services that are expected to be offered on a particular NFS unit and general environmental responses to various levels of management intensity.

The plan will guide development of future project and activity proposals. For example, if a particular unit plan includes an objective to increase old growth habitat to a certain percentage of the forested lands, it would not be expected that projects would be proposed to reduce the current amount of old growth habitat. The programmatic effect of approving a plan with this objective would, therefore, be a general prediction about the amount of old growth habitat and any potential trade-offs with other multiple uses. Similarly, if a plan included a standard that prohibited forest vegetation treatments within active northern goshawk nest areas during the active nesting period, proposals for forest vegetation treatments around active goshawk nest areas would include timing restrictions. The programmatic effect of this standard would be a general prediction about nesting conditions for goshawk reproductive success and any potential trade-offs with other multiple uses.

Only at the point of making project level decisions does the Agency commit resources or funding for on-the-ground action. Such site-specific decisions include, but are not limited to, authorizations for use and occupancy of NFS lands (e.g., outfitter and guide permits, right-of-way easements, and livestock grazing permits), vegetation management projects (e.g., prescribed burning, planting and seeding, and timber sales), and facilities/infrastructure projects (e.g., building campgrounds, removing roads, and replacing culverts). The effects of these site-specific actions can be predicted in terms of changes to the affected facets of the human environment: soil, air, water, vegetation, wildlife, social conditions, and economic costs/returns. Such effects can only be predicted with any certainty when site-specific actions are proposed.

Each level of decisionmaking is accompanied by environmental analysis and public involvement commensurate with the scope and complexity of the decision. The environmental analysis at each level would include any needed consultations with regulatory agencies. For example, the US Fish and Wildlife Service and National Marine Fisheries Service would be consulted in accordance with the Endangered Species Act, and State and Tribal Historic Preservation Officers would be consulted where and when appropriate in accordance with the National Historic Preservation Act.

As each decision becomes more specific (to approve a rule, plan, and project), the analysis of effects becomes more specific. 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.

Uncertainties exist at all levels of decisionmaking, such as the rate and effect of changing conditions outside the Agency's control, budget allocations, and the rates of plan implementation, and will influence anticipated outcomes.

Scope of Effects

The NFMA directs the Secretary of Agriculture to promulgate regulations that not only set out the process for development and revision of land management plans but also set out certain guidelines and standards prescribed by the statute. In turn, those standards and guidelines are reflected in the content of land management plans. Such guidelines and standards in land management plans would then guide and control design and approval of future site-specific management actions. Therefore, planning rule provisions for specific land management plan guidance will influence a responsible official's discretion when approving a land management plan and subsequent site-specific management activities.

Since specific project effects cannot be known at this time, this analysis must take a programmatic approach. The scope of the effects analysis is focused on the activities related to development, revision, amendment, and maintenance of land management plans and includes anticipated resource or process outcomes across NFS lands as plans developed under the various alternatives are implemented through project decisions. Potential programmatic effects include those associated with any changes in agency planning processes and plan content developed under current direction. This programmatic evaluation provides the public and the responsible official with useful information for considering the effects of land management plan development, revision, and amendment under each of the alternatives.

The effects of the proposed planning rule and alternatives are measured against the effect of taking no action (Alternative B). Taking no action means not revising the 2000 planning rule, which is currently in effect. The 2000 rule at 36 CFR part 219.35 provides an option to use the 1982 rule provisions to develop, revise, and amend land management plans until a new planning rule is promulgated. The Forest Service has been exercising this option to use the 1982 rule provisions rather than the 2000 rule provisions, and all revisions currently underway are using this option. The 2000 rule's planning process itself has never been used, and is not expected to be used because of cost and complexity. A full discussion of the reasons for not using the 2000 rule provisions for plan development, revision, and amendment are described under Alternative G in Chapter 2. Therefore, the 1982 rule procedures for development, revision, and amendment of land management plans, allowed by the 2000 rule as implemented, are considered the no action alternative.

The no-action alternative provides the basis for comparison of effects of the action alternatives. In this case, the effects of the land management planning process and plan content requirements of each action alternative are compared with the effects of current land management planning process and plan contents. To inform discussions concerning how current plans address certain topics in this chapter, a number of recently revised land management plans were reviewed along with their attendant environmental analysis and decision documents. While not seeking any statistical validity, a sample size of nine was determined to be sufficient to identify trends in contemporary implementation of the 1982 procedures for plan revision. 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);
- Allegheny, 2007, Pennsylvania (USDA Forest Service 2007a);

The scope of the following effects analysis is determined by the purpose and need for action and the significant issues, which are described in Chapter 1. To put the effects of the proposed planning rule and alternatives in context with other influences on Forest Service resource management programs, this chapter includes discussions of notable program actions that will occur regardless of which alternative is selected.

Effects described in this chapter would not be immediate, but would be manifested over time, as the rule guides revisions of existing land management plans or development of any new plans, and then as projects and activities implement the plans.

Dynamic Nature of Ecosystems

The following discussions provide context for subsequent sections on Climate Change, Ecosystem Restoration, Watershed Protection, and Diversity of Plant and Animal Communities.

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.

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 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 assist in organizing our understanding of these patterns (Hunter 1999).

Ecosystems are nested and exist at multiple spatial scales. Aquatic and terrestrial ecosystems are integrated and interdependent and change due to environmental interactions which vary at multiple temporal and spatial scales. Moreover, cross-scale interactions affect hierarchically structured ecosystems, where conditions or processes occurring over larger areas influence smaller embedded ecosystems, and properties of smaller systems emerge in the context of the larger system. Examining cross-scale interactions is critical, for example, in understanding the effects of climate change and various other stressors on the stability and resilience of ecosystems.

Early concepts of ecosystem stability and 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, as part of a predetermined equilibrium. The concept of homogeneous states, or homeostasis, has been refined to explicitly recognize that ecosystems are dynamic, open systems that are subject to change due to disturbance regimes and other natural processes (e.g., natural senescence). Contemporary views of stability and resilience are therefore not based only on the rate at which a system returns to an undisturbed state but includes consideration of the rate at which an ecosystem returns to a characteristic trajectory of change, termed homeorhesis or homeorhetic stability (O'Neil et al. 1986, Turner et al. 1993). Homeorhetic stability is due to the characteristic nature (e.g., fire, wind, and insects) and rate of disturbance associated with different types of ecosystems. These dynamics result in differing proportions of successional stages of varying composition and structure within the natural range of variability of ecosystems. This concept was implemented in LANDFIRE's national fire regime condition class mapping effort, in which departures of historical versus current conditions were estimated based on differences in proportions of successional stages, not differences in some pre-conceived undisturbed state.

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 as cited in Groves 2003). 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). Figure 2 provides a conceptual model of how these components interact at different levels of biological organization from genes to landscapes. Each component can be described at different levels of biological organization, from genes to landscapes. The components interact to maintain biological diversity (Noss 1990).

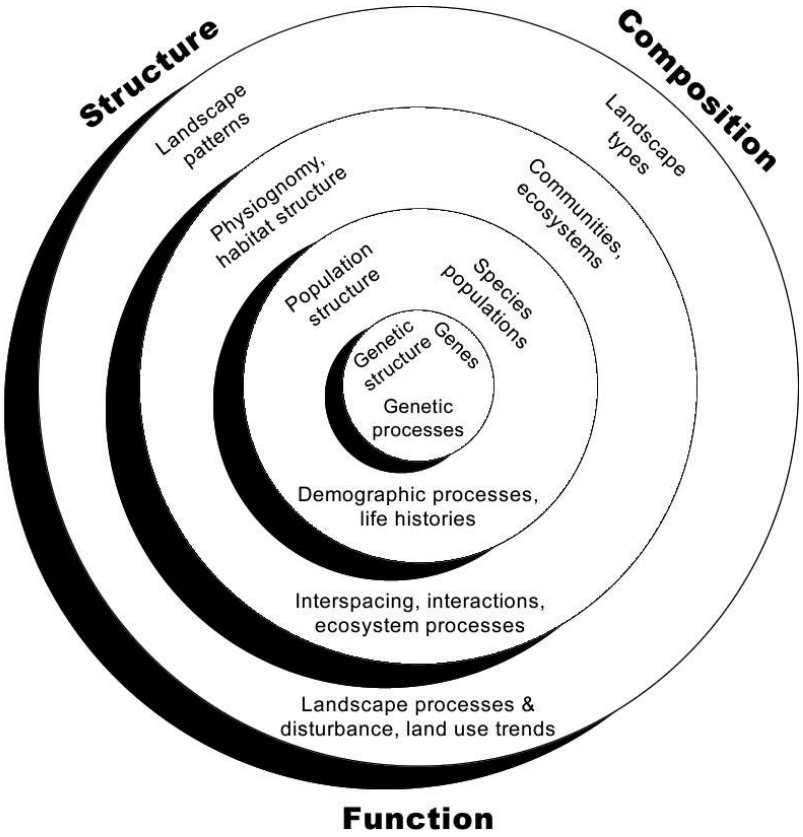

Figure 2 The Three Components of Biodiversity
Adapted from Noss 1990.

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 for example, 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 sustains composition and structure (Groves 2003). While these three components (structure, composition, and function) of ecosystems are inseparable, any complete discussion of biological diversity must recognize the extraordinary diversity of ecological and evolutionary processes that far outnumber the compositional and structural elements because they include the evolution of every species, all the ecological interactions among species, and a myriad of ecosystem and genetic processes (Hunter 1999). How ecosystems function and how they sustain the diversity of life within them is extremely complex, and our full understanding of them is still unfolding.

Based in part on increased understanding of historical ecology and the perception that it provides of temporal scaling, ecologists during the past few decades have begun to understand the dominant role of natural disturbance processes in ecosystems (Jackson et al 2009). Disturbance is inherent in ecosystems (White and Jentsch 2001) and, as a consequence, ecosystems are dynamic. Disturbance occurs at a broad range of spatial and

temporal scales and plays a critical role in the genesis and maintenance of ecosystem complexity (Pickett and Thompson 1978, Pickett and White 1986). Patterns we observe as a result of ecological disturbance depend on the characteristics of disturbance (e.g. frequency, intensity, and extent) and the spatial and temporal grain and extent of observation (Wiens 1989, Turner et al 1993). In fact, the interaction of the spatial extent of disturbance, the frequency of disturbance, and the spatial extent of the landscape being observed, determine, to a large extent, whether equilibrium, quasi-equilibrium, or non equilibrial patterns result from disturbance (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 quadrats and 'stands' to watersheds and drainage basins, so historical ecology has altered perceptions to focus on temporal dynamics (e.g., disturbance processes) at a range of temporal scales. Without the perspective developed from historical ecology, understanding disturbance processes would not be possible.

Acknowledging the dynamic nature of ecosystems and the importance of temporal scale in observed dynamics has lead to the further understanding that few systems exhibit the property of stationarity (variation occurring within limits about an average condition with that average remaining relatively constant over time) when viewed over the long-term (Milly et al. 2008). The consequences of this understanding drives home the need for an appropriate match between the management questions being addressed and both the spatial and temporal scale of ecosystem dynamics considered in assessments and effects analysis (Jackson et al. 2009). More important is the realization that the non-stationary property of system dynamics does not render the understanding of historical ecology impotent; rather, it changes the nature of how it is applied. Much can be predicted about the nature of potential future landscapes by applying an understanding of historical landscape ecology. A synthetic understanding of past temporal dynamics provides the foundation for predicting system dynamics in the future.

Inherent Capability of the Land

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 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. Therefore, a multi-scaled hierarchical approach is useful in understanding ecosystems. Ecological units, such as watersheds or terrestrial ecological units, are

classified to identify units 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 associated with flooding, wind, or fire. Nested hierarchical units provide a spatial context for evaluating, maintaining, and restoring desired ecological resources. The *National Hierarchical Framework of Ecological Units* (Cleland et.al. 1997) provides an example of how basic information about the nature and distribution of ecosystems can be used as a systematic method for classifying and mapping areas of the earth into nested *ecological units* based on associations of ecological factors at different geographic scales. The framework of ecological units assists in evaluating the inherent capabilities of land and water resources and the effects of management on them by delimiting areas of different biological and physical potentials. Climatic regime is an important boundary criterion for ecological units, particularly at broad scales. Climate, as modified by topography, is a dominant factor defining boundaries distinguishing units at upper levels of the classification hierarchy. Other factors, such as geomorphic process, soils, and potential natural communities, take on equal or greater importance than climate at lower levels.

With expected changes in climate, current climatic envelopes are expected to expand, contract, change, or completely go away, and new ones might 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 on the landscape, or completely disappear. 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 strong associations with site-specific conditions (such as unique surficial geology and soils, like serpentine soils) which 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 biodiversity 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 organisms have adapted to over evolutionary time is the management approach most likely to Maintain sustainable ecosystems (Manley et al. 1995 as cited in Baydack et al. 1999). Fundamental to this approach is the concept of representation (Noss and Cooperrider 1994), which aims to maintain on the landscape those ecological conditions that represent all of the variety of ecosystems. 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 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. 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 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.

HRV of areas in the western U.S. have been used in the development of management goals in federal and state management plans (FEMAT 1993 and Oregon Department of Forestry 2001, both cited in Nonaka and Spies 2005) and appear to be effective at evaluating whether trends are within or moving away from historic ranges and in 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, there are limitations in its 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 as such. 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 cited by Millar and Woolfenden 1999), 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.”

Ecological Integrity and Resilience

The concept of ecological or biological integrity is complex and related to many other terms, such as ecosystem resilience, resistance, and stability. *Biological integrity* can be defined as "the capacity to support and maintain a balanced, integrated, adaptive biological system having the full range of elements (genes, species, assemblages) and processes (mutation, demography, biotic interactions, nutrient and energy dynamics, metapopulation processes) expected in the natural habitat of a region" (Karr and Chu 1995 in Groves 2003). *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." 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-condition state following perturbation so as to essentially 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). Ecosystem resilience is the magnitude of disturbance that can be absorbed before the ecosystem irreversibly changes its structure as a result of a change in the variables and processes that control ecosystem structure and function (McNulty, pers. comm.). 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 adapt with the least loss of its function, structure, and composition. Resilient forest ecosystems tend to be stable, with the capacity to maintain a dynamic equilibrium while resisting change even under changing conditions (Diaz and Cabido 2001).

Resistance is the capacity of the ecosystem to absorb disturbance and remain largely unchanged. Forests that possess resistance change little in response to non-catastrophic disturbances, such as chronic herbivory, minor blowdown, or canopy gaps created by the death of individual or small groups of trees. They are also resistant to certain environmental changes, such as weather patterns, over time. Most well-developed forests, especially primary forests, are resilient and resistant to change (Holling 1973, Drever et al. 2006).

Resilient ecosystems tend to exhibit high biodiversity 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). Stable 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). 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 prominance 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 the forces of degradation and impairment that impinge on ecological integrity and ecological resources, such as specific species (e.g., altered hydrological flows on an endangered fish species), ecosystems (e.g., inappropriate grazing on a riparian community), or ecological processes (e.g., disruption of the natural fire regime on a ponderosa pine forest or tallgrass prairie). 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 non-native 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 a non-native 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, ecosystem, or process - 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 historic function of fire on the landscape (Groves 2003).

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 2009). 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 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 evapo-transpiration, 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). Effects 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. Species' vulnerability to climate change is determined by their exposure to climate change, their sensitivity to this change, and the adaptive capacity of the system. 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 introduced by our understanding of 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. For example, some models, including the Canadian model, project more extensive and frequent drought in the US, while others, including the Hadley model, 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 habitat s 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 maintenance or restoration practices is warranted. Applying our understanding of historical and current ecosystems 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).

Management in the Face of Uncertainty

With uncertainties introduced by climate change and other stressors, management approaches have been developed as alternatives to traditional natural resource management. The adaptive management approach is useful for many situations where high levels of uncertainty prevail (Stankey et al. 2005). Adaptive management is defined in the *Unified Federal Policy for a Watershed Approach to Federal Land and Resource Management* (65 FR 62565) as a type of natural resource management in which decisions are made as part of an ongoing science-based process. It involves hypothesis testing, monitoring, and evaluating applied strategies, and results in the ability to incorporate new knowledge based on the scientific findings into improved management approaches. This process can be used to continually modify management policy, strategies, and management practices.

Walters and Holling (1990) suggested several ways to structure adaptive management. These include incremental, passive, and active adaptive management. Williams, et al (2009) provided a model of adaptive management using a framework of an iterative process consisting of decisionmaking, monitoring, and assessment. They offer the following explanation of management approaches in the face of uncertainty:

> Management in the absence of systematic monitoring. Decisionmaking is loosely focused on management objectives and is based on prior experience, intuition, or expert opinion. Monitoring and assessment are not used systematically so there is little opportunity for learning.
>
> Management based on resource status. Decisionmaking is focused on achieving management objectives, with little or no recognition of uncertainty. Monitoring and assessment focus primarily on resource status rather than the understanding of ecological processes.
>
> Passive adaptive management. Uncertainty is recognized in a decision-making framework, but the focus is on achieving management objectives, with learning as an untargeted byproduct. Ongoing monitoring programs focus on resource status as well as other system attributes that are useful for improved understanding through time, and assessment produces estimates of resource attributes that are useful for learning.
>
> Active adaptive management. 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.

Adaptive management should be a collaborative effort among managers, scientists, and the public. The social dimension of adaptive management is about fundamentally changing the relationships among managers, scientists, and the public (Kusel et al, 1996).

The public engage as peers and partners with their manager and scientist colleagues to build active working relationships among themselves. (Buck et al 2001). This is a central concept to learning.

Adaptive management emphasizes management experience as a source of learning (Bormann et al. 1994) and employs an iterative process that links knowledge to action (Friedman 1987) and action to knowledge (Lee 1993). The approach assesses knowledge from a variety of sources and uses that knowledge to develop questions and hypotheses that can be tested, monitored, and evaluated to better inform policy and management (Bormann et al. 2007).

ECOSYSTEM RESTORATION

Affected Environment

There are many different definitions for ecosystem restoration. The Forest Service uses the following definition for *ecological restoration*: "The process of assisting the recovery of resilience and adaptive capacity of ecosystems that have been degraded, damaged, or destroyed. Restoration focuses on establishing the composition, structure, pattern, and ecological processes necessary to make terrestrial and aquatic ecosystems sustainable, resilient, and healthy under current and future conditions" (USDA Forest Service 2010i). 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).

By definition, the goal of ecosystem restoration—whether terrestrial or aquatic—is *ecosystem recovery*. Recovery involves restoring conditions capable of providing desired ecological goods and services. This result is best achieved by taking ecological history and site capability into account. A restored ecosystem should be able to sustain itself over time with minimal intervention. Although in some cases active management might be required, such as maintenance burns in fire-adapted ecosystems. Within normal ranges of environmental stress and disturbance, restored ecosystems should be inherently resilient, interacting with surrounding ecosystems in terms of biotic and abiotic flows and cultural settings (USDA Forest Service, 2006d).

Restoration inherently necessitates knowing what was there and how things operated in the past (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 of evaluating changes has been to compare the current state of ecological conditions on forests and grasslands to their historical range of variability (Landres 1999). This comparison examines the characteristics that were historically present on the landscape during a period of lesser human disturbance to a current condition to assess the degree of departure from then to now. This evaluation provides useful information about establishing desired ecosystem conditions necessary to maintain or support ecological integrity and the ecosystem services that these landscapes provide. This information is invaluable for guiding decisions related to ecosystem

restoration. Though, due to climate change, invasive species, extinctions, and social or economic factors, a reference ecosystem might not always be an appropriate goal or endpoint for restoration (USDA Forest Service 2006d). See the previous section on Historical Range of Variability as a Way of Understanding the Historical Nature of Ecosystems and Their Variation.

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 centuries. Native Americans set fires to herd game animals. Large scale logging at the turn of the 19th century dramatically altered vegetation age classes and species composition 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 provided for millions of acres of public lands that today range from largely undeveloped to wilderness areas. Continued urbanization, increased demands for goods and services, forest and grassland fragmentation, acid rain deposition, and changing climate continue to alter ecosystems on and off NFS lands. Concern has grown as evidence mounts that climate change is projected to exert additional stresses on native ecosystems (Thompson et al. 2009).

Past and current human induced stressors on NFS lands have resulted in changes to aquatic and terrestrial systems that impair ecological integrity and diminish resilience and resistance. 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). 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 could vary considerably depending on its location and ecological context (See previous section on Ecological Integrity and Resilience).

The following section provides examples of broad categories of some of the primary stressors existing on NFS lands, along with a brief overview of stressors, sources of stressors and potential effects associated with changes to:

- aquatic resources,
- vegetation composition and structure,

- landscape patterns and habitat connectivity,
- natural fire regimes,
- spread of invasive species and increased incidence and extent of insect and disease outbreaks.

Stressors Associated with Changes to Aquatic Resources

The majority (approximately 70%) of NFS watersheds is in Watershed Condition Class 1 or 2 (see Watershed Protection section). Condition Class 1 watersheds are considered healthy or properly functioning. Condition Class 2 watersheds are relatively healthy watersheds but might have identified problems or moderate restoration needs. Condition Class 3 watersheds are damaged, degraded, or destroyed and might require substantial investment to move to improved condition classes.

Not all NFS watersheds are in need of restoration, yet restoration needs exist. Dams, water withdrawals, and harvest in the uplands alter hydrologic flow patterns and channel stability. Sediment from roads or mass wasting events enters streams, changes sediment regimes, and increases water temperatures. Water related recreation changes riparian vegetation structure and shoreline stability. Wetlands might be filled for development of infrastructure resulting 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 Associated with Changes to Vegetation Composition and Structure

Overstory trees influence the structural and compositional characteristics of 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 like nutrient cycling and disturbance regimes. So changes to overstory composition, either through natural processes or management activities, will affect the type, number, and abundance of other species. Forest management activities that alter successional pathways, especially by homogenizing overstory composition, can change communities of other plants and animals. Even subtle simplification in overstory composition could result in the loss of other taxa. The establishment of single-species plantations at the expense of naturally mixed-species stands can result in significant shifts or losses of other species composition, especially for rare native species, due to structural and functional dissimilarities between the two (Palik and Engstrom in Hunter, 1999).

Alterations to forest and grassland vegetation composition, structure, and pattern on NFS lands have been occurring over the past century. 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 between early seral and late seral forest conditions (edge). So too, some livestock grazing practices have 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 that have occurred to 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).

Cumulatively, these alterations to 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. The abundance and distribution of plant and animal species associated with the specific vegetation communities affected by these alterations have thus been reduced. Two classic examples are the northern spotted owl, dependent on old-forest communities of the Pacific Northwest (Bart and Foresman 1992), and Kirtlands warbler, dependent on young forest conditions in northern Michigan (Probst and Weinrich 1993).

Stressors Associated with Changes to Landscape Patterns and Loss of Habitat Connectivity

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

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 Associated with Loss of 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 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 affects on rare species such as red-cockaded woodpecker and gopher tortoise, and on rare communities such as pitcher plant bogs.

Active fire suppression over the past several decades has disrupted, minimized or eliminated this important ecological process on many national forest and grassland units. A system to identify changes to the natural fire regime is the fire regime condition classes (or FRCC) that measures the degree of departure from the reference condition or the historical range of variability (Rollins et al. 2006, Schmidt et al. 2002) for each fire regime. The three fire regime condition classes used in this system and their current estimates are shown in Table 1.

Table 1 National Forest System Fire Regime Condition Classes

Fire Regime Condition Class	Acres
FRCC 1 Within natural (historical) range	47,000,000
FRCC 2 Moderate departure: a predominate percentage (33-66%)of the ecosystem has a moderate departure from reference condition	100,000,000
FRCC 3 High departure: a predominate percentage (>66%) of the ecosystem has a high departure from the reference fire regime	50,000,000
Total	197,000,000

Source: Menakis, personal communication.

Forest and grassland ecosystems in condition Class 3 have had high increases in density of shade-tolerant species or high loss of shade-intolerant species. Shrublands and grasslands in this condition class have had encroachment of trees, shrubs, or invasive exotic species. Fire regime condition Class 3 lands are considered to be at a high risk of losing key ecosystem components and these areas might require high levels of restoration treatments such as hand or mechanical treatments before prescribed fire can be used to restore the natural fire regime. Ecosystems in condition Class 2 have moderate levels of increased tree density or encroachment. The risk of losing key ecosystem components is

moderate and restoration treatments to restore the natural fire regime in these ecosystems might be less urgent.

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, disturbance such as stand replacement fires and widespread insect and disease outbreaks or other stressors such as widespread invasions of non-native species.

Stressors Associated with the Spread of Invasive Species and Increased Incidence and Extent of Insect and Disease Outbreaks

Non-native 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. Salt cedar and purple loosestrife are non-native 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.

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 cited in Sieg et al. 2010). 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 non-native 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 historic range of variability was evaluated and used to identify approaches to restoration. 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 corridors 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, and removal 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

A wide variety of ecosystem restoration activities have been and continue to be incorporated into land management plans and 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.

- 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.
- Precommercial thinning of young conifer stands that are overly dense, due to fire exclusion, or densely spaced plantations. 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 and structure.

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

- Functioning watersheds, with enhanced water quality and lower treatment costs for public water supplies.
- Productive systems 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 acres 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 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 restoration designed to maintain or improve ecological integrity across an entire landscape. 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.

Alternative A (Proposed Action) Effects

The objective of Alternative A is to guide planning to "promote healthy, resilient, diverse, and productive national forests and grasslands" (§ 219.1(c)). The requirements in Alternative A directly address the concepts of ecological integrity and the enhancement of resistance, resilience and adaptive capacity that are outcomes of improved ecological integrity (See previous section on Ecological Integrity and Resilience).

Under Alternative A, all plans would include components to:

- maintain or restore the structure, function, composition, and connectivity of healthy and resilient terrestrial and aquatic ecosystems and watersheds (§ 219.8(a)(1) and§ (219.9(a));
- maintain, protect, and restore aquatic elements (e.g., lakes, streams, wetlands, and shorelines); terrestrial elements (forest stands, grasslands, meadows, and other habitat types); rare aquatic and terrestrial plant and animal communities; public water supplies; soils; and riparian areas (§ 219.8(a)(2,3)) considering the integration of terrestrial and aquatic systems in the broader scale and potential stressors to these systems (§ 219.8(a)(1)); and

- maintain or restore ecological conditions for recovery of threatened and endangered species, conservation of candidate species, and viable populations of species of conservation concern (§ 219.9(b)).

The planning framework in Alternative A requires a collaborative and scientifically based process to assess differences between desired and existing ecological conditions, the inherent capability of the land, and the units' contribution to sustainable social, cultural and economic systems that would identify the need for restoration. Plans would have components related to restoration activities that would move the unit toward the desired condition. Monitoring at the unit and the broad scale would provide information on the implementation and effectiveness of restoration activities in improving ecological integrity and alleviating stressors and would help to validate assumptions about the effects changing conditions on resilience.

As plans are implemented over time, restoration activities that improve composition, structure, function and connectivity would increase ecological integrity of terrestrial and aquatic ecosystems. Stressors (both those that management can control and those that management has little control over) would continue to affect terrestrial and aquatic ecosystems. 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.

Alternative A essentially adopts the definitions of resilience and restoration (§ 219.19) currently in Forest Service directives:

> *Restoration*. The process of assisting the recovery of resilience and the capacity of a system to adapt to change if the environment where the system exists has been degraded, damaged, or destroyed. Ecological restoration focuses on reestablishing ecosystem functions by modifying or managing the composition, structure, arrangement, and processes necessary to make terrestrial and aquatic ecosystems sustainable, and resilient under current and future conditions.
>
> *Resilience*. The capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks.

Therefore, plan assessments would determine what plan components and management activities would be appropriate to maintain and restore composition structure, function and connectivity (ecological integrity) of terrestrial and aquatic ecosystems and watersheds. Plans would include components related to restoration activities. As plans are implemented over time, restoration activities that improve composition, structure, function, and connectivity would increase or maintain ecological integrity of terrestrial and aquatic ecosystems. Ecosystems with higher ecological integrity are expected to have increased resilience and resistance. Monitoring at the unit and the broad scale would provide more complete information on the implementation and effectiveness of

restoration activities which would allow managers to assess the effects of management in the context or the larger landscape.

Alternative B (No Action) Effects

Alternative B does not explicitly address the concepts of ecological integrity and the enhancement of resistance, resilience, and adaptive capacity that are outcomes of improved ecological integrity. Under Alternative B the planning process would identify grazing lands in less than satisfactory condition and actions planned for their restoration and provide for adoption of measures to restore floodplain values (§ 219.23(f)). Alternative B also has a specific requirement (§ 219.27(g)) 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. The species viability provisions (§§ 219.19 and 219.27(a)(6)), would continue to drive plan components to restore conditions to support vertebrate species.

Although restoration and resilience are not central objectives of land management planning in this alternative, plans recently revised under the 1982 provisions exceed current requirements and often include restoration of native ecosystems as a central objective. The trends previously described in the Affected Environment section would be expected to continue. Alternative B does not include definitions for restoration or resilience.

Since this alternative does not require monitoring of ecological conditions, plans developed under this alternative would be variable in their approach to monitoring restoration and resilience.

Therefore, plans would continue to include components to restore habitat conditions to support the viability requirements for vertebrates species (§§ 219.19 and 219.27(a)(6)). Implementation of the plans developed under this alternative would seek to restore conditions for the purpose of maintaining multiple uses and ecosystem services of interest to the public. 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 than under this alternative than under Alternatives A, C, D, and E. Restoration would be driven by policy and direction other than the planning rule (Endangered Species act, Clean Water Act, Agency policy, social pressure). Degraded ecosystems on NFS lands are expected to be restored, but the rate and extent of restoration is more uncertain under this alternative than under the other alternatives.

Alternative C Effects

Alternative C was developed from Alternative A, but 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. As a result, Alternative C retains the emphasis on restoration identified in

Alternative A, but removes many of the substantive requirements of the rule proposed in Alternative A.

The requirements in Alternative C do not directly address the concepts of ecological integrity and the enhancement of resistance, resilience, and adaptive capacity—outcomes of improved ecological integrity (See previous section on Ecological Integrity and Resilience). Restoration of ecosystem composition structure and function are 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 enhancement of resilience in different ways. That flexibility leads to 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 (e.g., riparian areas, source water protection areas, habitat of candidate species).

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

Alternative C does not have requirements for assessments, though recently revised plans have included assessment even though they are not specifically required under the 1982 provisions. While some form of assessment would likely continue under this alternative, there is more uncertainty as to what information assessments would be taken into consideration. This could 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.

Plans would include components to maintain or restore the structure, function, composition, and connectivity of healthy and resilient terrestrial and aquatic landscapes and watersheds (§ 219.8(a)).

The extent of monitoring and evaluation related to resilience and restoration would be highly variable among NFS units.

Management activities would be expected to continue the emphasis on resilience and restoration described in the conditions and trends in the Affected Environment section.

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. 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. As plans are implemented over time, restoration activities would vary across the NFS in their ability to maintain or improve ecological integrity.

Alternative D Effects

Alternative D would be expected to have similar effects on plans as those described for Alternative A. Alternative D is Alternative A with additional requirements for the planning process and plan content. The additional requirements are focused on species viability and aquatic and watershed conditions. Assessment under this alternative would occur at the landscape and/or watershed scale. Under Alternative D the planning processes and plan components would be similar to those described under Alternative A and in addition would include:

- Coordination across multiple planning units for species viability, in plan development, assessment, and monitoring and interagency coordination of the management of planning areas at the landscape level. (§ 219.4(c)(2)).
- Watershed scale assessments that include climate change vulnerability (§ 219.6(b)(6)).
- Plan components for resilient terrestrial and aquatic ecosystems (§ 219.8(a)(1)(v,vi)). Standards and guidelines would be required for:
  - Protection, maintenance, and restoration of riparian conservation areas (§ 219.8(a)(3)).
  - Protection, maintenance, and restoration of a natural range of variability in the sediment regime (§ 219.8(a)(4)(iv)).
  - Road removal and remediation in key watersheds and riparian conservation areas as the top restoration priority (§ 219.8(a)(4)(vi)).

Planning would take a landscape-scale approach to restoration of habitats to support species viability in which the planning unit would be only one land area of consideration. An expected outcome would be a landscape-scale restoration approach that uses a single process coordinated among multiple partners to determine appropriate plan components and monitoring plans for maintaining viability of species that occur on multiple units (See effects of Alternative D under the Diversity of Plant and Animal Communities section).

This alternative prescribes the ecological unit for assessment on all NFS units. 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 could 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 might not answer all questions related to 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 might be necessary.

Plans would include plan components (including standards and guidelines), restoration of riparian conservation areas, key watersheds, and sediment regimes.

The consequences of these requirements are discussed in the section on Watershed Protection in this chapter.

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 land owners and land managers engaged in species conservation. Three major differences between Alternative A and Alternative D are: (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.

Restoration, specifically road removal, in riparian areas and key watersheds would be the highest priority.

Alternative E Effects

Alternative E includes much of the rule language of Alternative A, with additional requirements for public involvement, collaboration, and monitoring. Under Alternative E there would be increased emphasis on evaluation of ecological conditions and resilience during assessment (§ 219.6(b)(1)(ii)). Alternative E expands the list of required monitoring questions and indicators beyond those required in Alternative A and requires that monitoring plans include signal points that alert the responsible official of the need to take action (§ 219.12(a)(9)). All plans would include monitoring questions and indicators related to provide information on:

- 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.

Nationally prescribed monitoring questions and the required signal points would lead to the collection of more information about restoration and resilience. It is unclear that all of these questions and indicators would be important to informing restoration needs on each planning unit or that 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 might not be able to be monitored as resources would go to meet the required questions. Standardized monitoring question and methods could allow for data to be aggregated more efficiently answer questions at higher ecological unit scales and might be more comparable between units.

In all other respects related to restoration and resilience, Alternative E is expected to be similar to Alternative A.

The effects of Alternative E would be similar in most respects to those of Alternative A. Additionally:

- There would be more evaluation of ecological conditions and resilience during assessment for plan revisions and more monitoring of specific conditions and response to restoration.
- 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 is 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 might also result in collection of data that is not necessarily relevant to the management of individual units or ecological conditions.

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 cited in Furniss et al. 2010).

The U.S. 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. 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. 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 classification approach was designed and implemented that uses annual outcome-based performance of progress toward improving watershed condition on NFS lands (Potyondy and Geier 2010). From that product, the FS has developed the Watershed Condition Framework which provides a consistent process for assessing watershed condition, identifying watersheds that are a priority for restoration or maintenance, implementing projects that move watersheds toward improved condition classes and tracking and monitoring accomplishments.

The USDA Strategic Plan FY 2010-2015 (USDA 2010) 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 watershed 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. s.

According to the Forest Service Performance Accountability System database, of the more than 12,000 sixth-code watersheds with significant NFS land ownership, 25 percent are in poor condition. Only 30 percent of watersheds on NFS land are reported to be in good condition. Watershed condition for all NFS watersheds is currently being reassessed. The above numbers are expected to change somewhat as a result of reclassification.

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. 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 on Ecological Integrity and Resilience). The key processes and functions related to resilience 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 actions that might be implemented 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)

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 2010) and refer to increasing the proportion of watersheds in good condition based on recent Forest Service policy changes 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 is expected to continue 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 was adopted in 2005 and has been a focus for reducing impacts of NFS roads. The number miles of roads decommissioned and bridges constructed or reconstructed has increased and the miles of road constructed have decreased between 2007 and 2010 (Table 3). Under current funding levels, approximately 1/2 of 1 percent of the total NFS road system is decommissioned annually.

Table 3. 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 intent 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. 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.

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.

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; nevertheless, 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). Although methods to restore decommissioned roads have been tested, there is also evidence that simply closing roads might be more effective than some restoration methods that have been tried (Elseroad et al. 2003). 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.

The final rule for the determination of threatened status for bull trout (USDI Fish and Wildlife Service 2010) states that "Roads and other activities above the ordinary high water mark or bankfull elevation of streams, and upstream in watersheds can directly or indirectly impact bull trout habitat in streams. To protect bull trout habitat, the Fish and Wildlife Service will continue to evaluate impacts on a site-specific basis and develop appropriate avoidance, minimization, and mitigation measures during section 7 consultation on Federal actions." The final bull trout rule requires best management practices and improved maintenance of roads and drainage, but there is not a requirement for limiting road densities, even in relation to habitat of threatened salmonid species.

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 in 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 is 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, 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 3 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 4 shows the number of miles of stream and riparian habitat restored or enhanced between 2002 and 2010.

Table 4. 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).

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 (Oakly et al. 1985, cited in Everest and Reeves 2007), 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. 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.

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 has been to find the minimum level of protection needed to maintain productive riparian and aquatic habitats (Everest and Reeves 2007). Often BMPs 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 1995). 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 (USDA Forest Service 2002b). 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 (USDA Forest Service 2002b).

Under the provisions of the 1982 planning rule, riparian areas are considered geographically delineable areas that are transition zones between aquatic and terrestrial ecosystems. These areas have distinctive vegetation communities that require free or unbound water. The policy under the 1982 provisions is to give “special attention” to these areas, which are approximately 100 feet from the edges of bodies of water, and within these areas to limit management practices that can seriously and adversely affect water conditions or fish habitat.

Plans recently revised under the 1982 rule procedures are quite variable 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 provide for a 300-foot habitat zone. Other plans specify 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 will 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. Since the Organic Act (16 U.S.C. 475), it has been the responsibility of Federal land managers to protect and restore water resources on Federal land. 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 (*Federal Register* 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 (OMB 2006).

Recently revised plans are quite variable 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 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 every fifth year.

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.

Alternative A (Proposed Action) Effects

Watershed Condition

Alternative A requires that plans include components to maintain or restore the structure, composition, function, and connectivity of aquatic and terrestrial ecosystems and watersheds. This is accomplished under a planning framework that includes assessment, planning, and monitoring, in a continuous learning cycle (§ 219.5). This alternative highlights the need for flexibility to accommodate new information as it becomes available and for guiding the responsible official in using the best available scientific information to inform development of plan guidance.

Enhancing the effectiveness of observation networks and current monitoring networks would provide information for the early detection of and ecological change associated with climate change (Joyce et al. 2009). Plans developed under Alternative A would include a two tiered monitoring plan including a broader scale monitoring strategy to address monitoring questions that can best be answered at a scale broader than the unit (§ 219.5). This requirement would increase the effectiveness in monitoring indicators of watershed condition as many stressors and often the greatest impacts on NFS watersheds

are generated beyond NFS boundaries. The unit-level 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. The unit-monitoring program sets out unit-monitoring questions and associated indicators that would be designed to inform the management of resources on the unit. Section 219.12 includes eight specific requirements for every unit-monitoring program. This set of requirements is designed to link the monitoring program back to the assessment and plan development or revision phases of the planning framework and to the substantive content requirements set forth in other sections of the proposed rule, thereby creating a feedback loop for adaptive management. A range of monitoring techniques could be used to meet the eight specific requirements.

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 including ecosystem services in § 219.10.

The connected nature of watersheds—and the fact that there are often multiple owners, interests, and values—requires collaboration for effective watershed management. The scientific literature suggests that the most important components for maintaining watershed condition include restoration of resiliency, collaboration across ownerships, priority setting, and adaptive planning processes in the face of changing conditions (Furniss et al. 2010). This alternative emphasizes collaboration and working with partners across the landscape in all phases of the planning cycle. Planning would use an all-lands approach by requiring assessments to consider and evaluate existing conditions, trends, and potential future conditions across the broader landscape (§ 219.7). Based on the information from the assessments, responsible officials would identify the unique role(s) and contributions of the unit within the broader landscape (§ 219.8(a)(1)).

Watershed health is a function of the health of both the terrestrial and the aquatic systems because water links these systems (Verry and Dolloff 2000). Under Alternative A, the responsible officials would take into account landscape-scale integration of terrestrial and aquatic ecosystems and the potential stressors and disturbance regimes and their effects on watershed health and resilience when developing plan components (§ 219.8(a)(1)).

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." Alternative A 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 at the national level, this alternative would allow the flexibility to determine the most appropriate ecological unit on which to base assessments, gather information, or monitor as long as the responsible official is able to demonstrate the best available scientific information has been taken into account (§ 219.3) and the information is available to fulfill the requirements of §§ 219.7 through 219.10.

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. Alternative A requires the identification of watersheds that are a priority for restoration or maintenance (§ 219.7).

As plans developed 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). (See previous discussion on Dynamic Nature of Ecosystems as well the Ecosystem Restoration section of this DEIS.)

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.

Road System

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—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 where impacts exist. This alternative recognizes the variability of conditions and the 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. Therefore, 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 the reducing the impacts of roads on watershed health rather than on reducing the density of roads within the watershed.

Under 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 is expected to continue. Prioritization of where to decommission roads could be based on impacts to watersheds, habitat or other resources, road density standards, or other factors.

Riparian Area Management

Alternative A requires that plans include components to maintain, protect, or restore riparian areas (§ 219.8). Plans must establish a default width for riparian area management around all lakes, open water, wetlands, and perennial or intermittent streams that would apply unless the actual riparian area has been delineated based on the best available scientific information. It does not prescribe a specific width for riparian areas or default riparian area management zones; instead it allows for those widths to be defined at the unit level. Riparian areas often served as corridors for ecological connectivity. This alternative also requires that plans include components for connectivity of healthy and resilient terrestrial and aquatic ecosystems and watersheds (§ 219.9).

Verry and Dolloff (2000) state that protection capabilities of riparian areas must be supported by careful management of forests upslope and outside of riparian areas. This alternative treats watersheds, including riparian areas, holistically by requiring that the responsible official take into account landscape-scale integration of terrestrial and aquatic ecosystems, the potential stressors and disturbance regimes, and their effects on watershed health and resilience (§ 219.8).

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. Alternative A has a maintenance and restoration focus and requires that plans include components to maintain or restore the structure, composition, function, and connectivity of healthy ecosystems and watersheds including riparian areas (§ 219.8(a)(1)). (Also see discussion of effects under Watershed Condition and Ecosystem Restoration.)

Plans created or revised under this alternative would more consistently include plan components for riparian protection and restoration (§ 219.8) than is currently required (Alternative B); however, as noted under the Affected Environment section, recently revised plans often exceed the riparian management requirements of Alternative B. As these plans are implemented, riparian area values such as temperature regulation, large woody debris recruitment, bank stabilization, and others would be expected to improve.

Water Quality

See effects under Watershed Protection, Riparian Areas, and Road System. In addition, under this alternative, the responsible official would take into account the impacts and potential stressors and how they could affect water quality, quantity, and availability (§ 219.8(1)(ii)). This alternative, as do 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)). Plans would also 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, protect, and restore public water supplies; sole source aquifers; source water protection areas; and groundwater(§ 219.8(2)(iv)). This alternative increases the emphasis on managing for sustainable water quality and quantity relative to what is currently required. 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.

Alternative B (No Action)

Watershed Condition

Alternative B does not include requirements for developing plan components specific to watershed restoration, but instead focuses on suitability for use (§ 219.14) and requires adoption of measures to minimize risk of flood loss, to restore and preserve floodplain values, and to protect wetlands (§ 219.23). 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. 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 health. The Agency's increased emphasis on improving watershed conditions and assessing changing conditions can be expected to continue, and future plans could reflect that emphasis. However, there is a greater degree of uncertainty of that under this alternative than under Alternatives A, D, or E.

It is possible 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 mitigation approach, particularly where natural disturbance patterns are absent. Watersheds currently in poor condition would remain in poor condition or might degrade further.

Road *System*

Alternative B requires 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(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. It 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 (§ 219.27(11)).

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.

Riparian Area Management

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.

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. In the absence of natural disturbance or management activities that mimic natural disturbance, riparian health can decline (Everest and Reeves 2007, Pickett and Thompson 1978, Pickett and White 1986, Milly et al 2008).

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 the current planning regulations.

It is possible that some plans created or revised under this alternative could take a strictly mitigative approach (by establishing BMPs) 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 1995).

The Agency's increased emphasis on improving watershed conditions and assessing changing conditions can be expected to continue and future plans could reflect that emphasis; however, there is a greater degree of uncertainty of that under this alternative than under Alternative A, D, or E. Alternative B focuses on mitigating adverse effects of management actions on riparian area values, but it does not emphasize restoration or maintenance of these areas.

Water Quality

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, 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.

Alternative C

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 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 there would be high variability in what guidance is provided among plans. To some extent, the reduced requirements for public involvement, assessment, and monitoring under this alternative 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, streambanks, 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 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 required by Federal law (Clean Water Act), plans would be required to address potential watershed conditions that would contribute to water pollution (§ 219.2). As stated in the Alternative B discussions on watershed condition and road systems, 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.

Alternative D

Watershed Condition

This alternative consists of the provisions of Alternative A with additional or more prescriptive requirements for watershed protection and restoration. Effects of this alternative would be similar to Alternative A. In addition, under this alternative the 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).

Alternative D specifies many of the same elements for watershed management as the Northwest Forest Plan (USDA Forest Service, USDI Bureau of Land Management 1994) and the Tongass Land Management Plan (USDA Forest Service 2008a). Everest and Reeves (2007) 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. On the other hand, 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 watershed function across highly variable systems. 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).

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. Watersheds are neither equally valuable nor equally vulnerable to adverse impacts. Setting management priorities can help ensure that investments provide the greatest possible benefits. Planning (at the project or the plan level) can also 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). This alternative is consistent with agency policy for setting priorities for watershed restoration and assessing watershed condition and addressing the effects of climate change.

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). At the national scale 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.

Road System

This alternative consists of the provisions of Alternative A with additional or 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 36 CFR 212.5(b)(1) and (2).

Alternative D includes specific direction related to roads, including establishing standards and guidelines for road densities in key watersheds. The effects of this alternative on watershed condition are uncertain. 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. 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, personal communication). 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 would be an ineffective tool for maintaining and restoring watershed condition.

Also, there is conflicting evidence on whether there is a direct cause-and-effect relationship between road density and water and aquatic habitat quality.

This alternative also requires that road removal and 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.

Also, restoration priorities (such as public safety, habitat for threatened or endangered species, or restoration of riparian vegetation) are site- and time-dependant. Plans that include specific actions or site-specific priorities can quickly become outdated as conditions change.

Riparian Area Management

The effects of this alternative are similar to Alternative A. In addition, this alternative has 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). Establishing a default width is a fairly well-supported and 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. There is little scientific evidence that indicates whether a set or variable default riparian width would have differing effects on riparian areas, particularly as the default width is a temporary measure until actual functional riparian areas are delineated.

Under this alternative all plans would include 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. 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.

Riparian areas often serve as corridors and connecting points between watersheds. In this alternative, plans would also include standards and guidelines to maintain biological and biophysical connectivity of key watersheds across the planning unit (§ 219.8). (See previous sections on Ecosystem Restoration and Ecological Integrity and Resilience.)

Water Quality

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). 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 on Historical Range of Variability as a way of understanding the Historical Nature of Ecosystems and Their Variation and Stressors and Their Influence.) Because historical ranges of variation traditionally used as references for restoration are often inappropriate in the face of changing climates, re-alignment with current process and dynamics could facilitate recovery and adaptation to changing climate more so than restoration to historic pre-disturbance conditions (Millar and Brubaker 2006 and other references cited in Joyce et al. 2009). The added requirements might also not be appropriate for all NFS units, could be data intensive, and might constrain or delay other management actions that could address known sediment problems.

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 cited in Joyce et al. 2009). 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.

DIVERSITY OF PLANT AND ANIMAL COMMUNITIES

Affected Environment

Background and Context

This portion of the Affected Environment provides background information and context regarding the "provide for diversity of plant and animal communities" requirement in the National Forest Management Act (NFMA). 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.

The 193 million acres of national forests and grasslands support much of North America's wildlife heritage, including: habitat for 429 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) species recovery plans and actions. 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 are examples of how the Agency continues to contribute to T&E recovery.

A biological evaluation (BE) is required by the Agency to analyze and document any potential effects of a proposed project, activity, or program on threatened, endangered, or Forest Service listed sensitive (TES) species or critical habitat; and to determine the conservation significance of such effects. A biological assessment (BA) is prepared to determine whether a proposed action is likely to: "may affect" a federally listed T&E species or a species proposed for federal listing or designated critical habitat; "adversely affect" a listed species or critical habitat; "jeopardize" the continued existence of a species that is proposed for federally listing; or "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 (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 habitat. 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 the relevant regulatory agency (U.S. Fish and Wildlife Service or National Marine Fisheries Service). Approximately 80 percent (10,500) of those proposed actions resulted in a determination of "may affect, not likely to adversely affect," which means that the effects on T&E were discountable, insignificant, or completely beneficial. Many of these actions were beneficial to T&E species or designated habitat. For each of the approximately 2,500 remaining proposed actions where the Forest Service identified potential adverse effects to T&E, the Agency formally consulted with one of the regulatory agencies to determine whether the project, program, or activity would 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 regulatory agency determining 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. In some cases, actions proposed by the Agency were modified in order to avoid a jeopardy opinion.

Land management plans developed under the provisions of the 1982 planning rule are the primary source of direction for maintaining species viability, 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 have all have greatly influenced forest and grassland plan components and the use of evolving approaches to achieve biological diversity conservation on NFS lands.

In order to estimate the effects of management actions on fish and wildlife populations, the 1982 rule regulations rely primarily on selecting and monitoring management indicator species (MIS). 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. With the incorporation of new biological and ecological information, changes in Agency policy and direction, and additional stressors on plant and animal communities, some 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 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 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, though 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. Regardless of which planning rule alternative is selected, 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 to species diversity from these factors. However, the ability of the Agency to 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 viability of all species native to those areas or contribute to viable populations of species whose populations extend beyond the plan area is uncertain. Expected changes in climate over the next several decades will influence existing or expected habitat conditions, species distribution, and landscape connectivity. See previous section discussing Stressors and their Influence.

Insect and disease epidemics, large, high-intensity wildfires, changing atmospheric conditions and the spread of non-native invasive species are examples of other types of environmental stressors that can be highly unpredictable and difficult for the Agency to manage for or control. These too will influence ecological conditions and species diversity on national forest and grassland units. Additionally, changing land use patterns and activities on lands adjacent to national forests and grasslands, or changes occurring at a distance from such lands, such as on migration routes or wintering grounds might also affect species distribution and viability within plan areas.

The shifting nature of the Agency's budgets, staffing, and program emphases will continue to occur beyond the authority 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 assumptions relevant to plant and animal diversity on NFS lands:

- 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.
- 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 are concentrated have remained unchanged for the past decade and include the southern Appalachians, coastal areas, and the arid Southwest.

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

Current Science

Maintaining species 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 behind biological diversity concepts and principles associated with them. This portion of the Affected Environment section provides a brief background of the current science related to these three aspects of this issue.

Maintaining Species Viability

Long-term security of species improves as their distribution increases and the habitat conditions they require improve. Since many species occupy landscapes simultaneously

and since the sum of species in an area is collectively termed biodiversity, the maintenance of biodiversity requires providing the sum of those species habitat conditions necessary for their survival across the landscape. Current conservation biology literature discusses a variety of approaches to conserving biological diversity across broad landscapes. 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 include bioreserve, emphasis-area, coarse-filter, and fine-filter strategies and various combinations of these (Baydack et al. 1999, Noon et al. 2009). The evaluation and analysis of the approaches proposed within the alternatives being analyzed in this draft programmatic environmental impact statement focus on the coarse-filter (ecosystem) and fine-filter (species) approaches.

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 because either the critical habitat elements for species are unknown or, if known, the condition of the habitat is variably different than optimum and there is uncertainty as to the effect on species. 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 across the landscape. In order to reflect underlying ecological processes, coarse-filters 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.

Coarse-filters generally do not rely on direct measurement of wildlife species (Noon et al. 2009). Providing or emulating a full range of ecological conditions similar to those to which 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 an effectively designed coarse-filter contributes to the overall biological diversity across the entire plan area. With a biologically effective coarse-filter strategy in place, the more costly and information-intensive fine-filter strategies can be focused on the few species of special concern (Seymour and Hunter 1999). Critical to the design of an effective coarse-filter is the classification of a planning area into biologically meaningful ecological communities. 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, is problematic and injects a level of uncertainty into the overall effectiveness of the design (Haufler et al.1999). See previous section on Historical

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

Fine-filter strategies 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 strategy 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 are more reliant on direct measurements of individual species' critical habitat elements needed for survival, distribution, abundance, and other life requirements and demographic information. Some advantages to a fine-filter approach are that it can better address the needs of federally listed species and other at risk species that might not be adequately considered through use of even a well-designed coarse-filter, and it could be designed in such a way 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.

Managing Ecological (Habitat) Conditions

The best opportunity for maintaining species and ecological productivity is to maintain or restore the composition, structure, and ecological functions characteristic of the ecosystem. This approach provides 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 landscape scales (Haufler et.al. 1999b). Examples of *compositional characteristics* of ecosystem diversity include: distribution and extent of major vegetation types; presence and distribution of invasive species; and types of wetlands, lakes, streams, and ponds. *Structural characteristics* include: vertical and horizontal distribution of vegetation and its pattern; size of trees and understory vegetation; density, size, seral stage, and distribution of dead wood; landscape patch characteristics and connectivity among habitats; stream habitat complexity; and riparian habitat structure. Examples of *ecological functions* include: 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 regimes; 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 on Dynamic Nature of Ecosystems.

Monitoring to Assess Effectiveness

Evaluation and analysis of monitoring approaches analyzed in this draft programmatic environmental impact statement focus on the use of MIS, focal species, and ecosystem characteristics. 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. Plans should contain monitoring measurements and methods at multiple 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 relatively site-specific based upon geographic variation in patterns of habitat and resource use.

Ecological conditions can be monitored by measuring various indicators of ecosystem composition, structure, and function. Filter-based approaches to monitoring ecosystem indicators for multi-species conservation, account for both coarse- and fine-scale processes that are important to maintaining biological diversity across a landscape. Filter-based approaches generally characterize ecological systems in terms of indicators of function, structure, and composition (Lindenmayer et al. 2000). 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, landscape pattern; these could be measured at multiple spatial scales from local to regional. 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).

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 and changes to biological diversity. A wide 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, Weins 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 indicators 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 change 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).

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.

The selection of management indicator species (MIS), as described previously, is required under the 1982 planning rule and serves a wide range of purposes. 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 to some other species; for example, acreage of occupied prairie dog habitat and its inferences for the occurrence, distribution, and persistence of burrowing owls, ferrets, and mountain plovers; or the presence of beaver and their influence on sediment capture, water storage,

riparian habitat development, or aquatic habitats. However, there is also evidence that the selected species have not provided the ecological information needed to assess habitat conditions or other species populations (Hayward et al. 2004).

There could be other species level monitoring occurring on a NFS unit for reasons unrelated to plan implementation and effectiveness, such as a T&E species or species of conservation concern.

Evaluation of the Alternatives

Maintaining species 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. Each of the alternatives being analyzed will be evaluated based upon their approaches to these three indicators. The current science portion of the Affected Environment provided above will serve to inform the evaluation and analysis of an alternative's approach to each of these indicators.

Alternative A (Proposed Action) Effects

Maintaining Species Viability

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

The provisions of § 219.9 of Alternative A require a complementary ecosystem diversity and species conservation approach to maintaining the diversity of plant and animal communities in the plan area. This represents a combination of the coarse-filter and fine-filter strategies for maintaining the biological diversity and is intended to provide the full range of ecological conditions to which native species have adapted to over the past several hundred years. There are recognized advantages to combining the two approaches, largely based upon 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). It is fundamentally different from 1982 planning rule approach in that it focuses on sustaining ecological conditions necessary to provide for species diversity using a coarse-filter/fine-filter approach. This combined approach 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 the desired ecological conditions, the focus for maintaining viable populations 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 under the proposed action (§ 219.9) requires that plans include components to maintain or restore the structure, composition, function, and ecological connectivity of terrestrial and aquatic ecosystems in the plan area. It 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. The ecosystem diversity requirement is intended to provide the ecological conditions and characteristics, at a variety of scales, which support the long-

term persistence and resilience of a large majority of species and plant and animal communities within the plan area. See previous section on Dynamic Nature of Ecosystems. 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 conservation approach is expected to be the best opportunity to conserve species for which their abundance, distribution, life histories, and habitat relationships are largely unknown. It provides for analysis and management efficiency by addressing characteristics of ecosystem diversity rather than hundreds or thousands of individual species. It is predicated upon an understanding of the historic 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 on HRV and on Stressors and Their Influence. It 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 might not be fully addressed under the coarse-filter approach alone, a complementary fine-filter approach might be needed and be possible to use for some species to serve as a "safety net" (Hunter 1990). This rule language specifies the categories of species for which the fine filter might be appropriate: species that are federally listed as threatened or endangered, for which recovery actions have been identified (recovery plans) to prevent extinction; 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 continued representation within a particular plan area is a concern (species of conservation concern). The species conservation requirement (§ 219.9) under the proposed rule directs plans to: examine the efficacy of the ecological conditions provided under the ecosystem diversity (coarse-filter) requirement in contributing to the recovery of federally listed threatened and endangered species, conserving candidates to Federal listing, and maintaining the viability of other identified species of conservation concern; and where necessary, include additional species-specific plan components needed to maintain viability of at-risk species on national forests and grasslands. It provides a complementary fine-filter "catch" for species not conserved by the coarse-filter approach by evaluating the full complement of potential stressors, such as human disturbance, road and trail placement, food storage, etc. under management control—not just habitat or vegetation—on those species.

The proposed rule language (§§ 219.8 and 219.9) under this alternative clearly recognizes that required plan components for maintaining or restoring ecological conditions and maintaining plant and animal diversity 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 climate change, Amazon clearing, private land fragmentation and development, invasive species, disease, etc). It requires that the public participation, collaboration, and coordination process consider an all-lands approach beyond the plan area. It 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 that plan areas would contribute conditions that support viability of species across their range. Because many species within the plan area are dependent on habitat both on and off NFS lands, and might 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 more timely information with which to address species conservation concerns in the future. Additionally, for identified species of conservation concern, this rule language directs the responsible official to coordinate, to the extent practicable, with other land managers on conservation activities that contribute to the viability of these species across the species range.

Therefore,

- 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 the approach provided 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.
- Plans would emphasize ecological restoration and connectivity and, where necessary, provide species-specific plan components focused on species conservation (§ 219.9). As these plans are implemented, habitat conditions for many federally listed species, candidates for listing, and species of conservation concern are expected to improve within and among plan areas.
- Planning would recognize the need to coordinate conservation measures with other land managers (§ 219.4) for species of conservation concern 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 range-wide concerns of these species.
- Planning 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 other species of conservation concern.

Managing Ecological (Habitat) Conditions

Under the proposed rule, an assessment (§ 219.6) of the ecosystem characteristics within the plan area is to be conducted as part of the planning process. This assessment would identify the ecological conditions needed to support all native species within the plan area. The proposed rule then requires plan components, i.e., desired conditions, objectives, suitability of areas, standards, and guidelines (§ 219.7), for maintaining or restoring characteristics of ecosystem diversity (composition, structure, function, and

connectivity) necessary to support healthy and resilient terrestrial and aquatic ecosystems. It focuses on providing the ecological conditions—factors more directly under Forest Service authority and control, including vegetation, aquatic and terrestrial habitat, roads, structures, facilities, and public use—rather than the actual individuals or populations of species. There are two primary reasons for this focus. First, the Agency can only provide the 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 independent of existing ecological conditions provided (e.g., weather, disease, climate change, competition, or broad-scale population declines). The proposed rule provisions require plan components for providing the full suite of habitats, at a variety of scales, which are characteristic of the plan area. This alternative requires that plans provide, where feasible, for biological communities and natural disturbance processes to sustain ecosystems. Required plan components needed to maintain or restore the characteristics of ecosystem diversity are expected to be informed by a variety of 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 ecological capability of the area, biotic integrity, existing and projected climate envelopes, and others. Additional plan components would be required, where necessary, to provide for habitat features or habitat effectiveness needed to contribute to recovery of federally listed species, to conserve candidate species, and maintain viability species of conservation concern.

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 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,

- Planning would assess ecosystem diversity characteristics (§ 219.6) and incorporate specific plan components that focus management activities on maintaining and restoring ecological conditions (§§ 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 protection and restoration measures for riparian areas (§ 219.6). The implementation of these measures is expected to result in improved streamside, wetland, lakeside, and aquatic habitats, especially for aquatic and riparian species.

Monitoring to Assess Effectiveness

Section 219.12-Monitoring in the proposed planning rule sets forth requirements most relevant to monitoring ecological conditions on national forests and grasslands. It requires monitoring questions that address the status of key ecological conditions

affecting species of conservation concern and ecosystem diversity, focusing on threats and stressors that could affect ecological sustainability such as management activities, invasive species, or climate change; and the status of a small set of focal species selected to assess the degree to which ecological conditions are supporting diversity of plant and animal communities within the plan area. It focuses on monitoring ecological conditions when assessing the effectiveness of the ecosystem diversity and species conservation requirements. Measuring and monitoring key ecosystem characteristics related to composition, structure, function, and ecological connectivity along with a set of well-chosen focal species should provide timely information regarding the implementation and effectiveness of plan components related to plant and animal diversity and species viability.

The concept of MIS is not included in the proposed rule because scientific evidence has identified potential flaws in the MIS concept, or in its application, for assessing the effectiveness of plan implementation and its relationship to maintaining viable populations of vertebrate species within a plan area. The proposed approach to monitoring does not rely on establishing a species population trend in order to infer relationships to habitat changes. Rather, this alternative relies primarily on monitoring and assessing key measurable ecosystem characteristics (compositional, structural, and functional) related to desired ecological conditions, and a small set of 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 diversity focuses on whether plan components are being implemented properly and whether the unit is making progress toward achieving its desired ecological conditions. Unlike MIS, focal species are not specifically intended to directly indicate effects of management activities on other species associated with the same or similar habitats. Rather they are selected to provide insight into the integrity of ecological systems on which species depend and the effects of management and other stressors on those ecological conditions. 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 plans, including the selection of focal species, would be developed in conjunction with research entities and would utilize the best available scientific information.

The emphasis on the role of science (§ 219.3) and expanded public participation, collaboration, and coordination process (§ 219.4) and the two-tiered monitoring strategy (unit and broad scale under § 219.12) required under the proposed rule would 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,

- Plans would include ecological monitoring elements (ecological conditions, ecosystem characteristics, and focal species) (§ 219.12) that would be more effective and efficient than those under the 1982 planning rule at assessing the diversity of plant and animal communities and long-term persistence for all 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 (§ 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 allow for 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 than the approach taken under the 1982 rule.

Alternative B (No Action) Effects

Maintaining Species Viability

Section 219.19-Fish and Wildlife Resource, § 219.26-Diversity, and § 219.27-Management Requirements in the 1982 planning rule set forth requirements relevant to maintaining plant and animal diversity on national forests and grasslands.

Under the 1982 rule, the requirement to manage habitat to ensure species viability is specific to native and desired non-native vertebrates only, even though 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 "insure *[a vertebrate species']* continued existence is well distributed in the planning area" (as required under the 1982 planning rule) is problematic, especially for threatened or endangered species, whose viability is already imperiled and whose range and major recovery efforts might not be largely associated with NFS lands. The Puerto Rican parrot, woodland caribou, steelhead salmon, 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 the similar habitat conditions is largely unsupported in the scientific literature.

Following the 1982 planning rule, the Agency adopted directives that required national forests and grasslands to recommend to their regional forester those species whose

viability was a concern rangewide or within the plan area. These species were subsequently listed as regional forester sensitive species, 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 1982 provisions 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. These types of actions are consistently included in the development or revision of a plan, and most national forests and grasslands continue to contribute to the recovery of threatened and endangered species.

Therefore,

- 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 (§ 219.19). Because the species viability requirement is explicit to vertebrates, plans might 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.
- Plans would continue to provide explicit fish and wildlife conservation language, even though the population viability requirement is explicit to vertebrates, which has benefitted these resources in the past. This would be expected to continue as plans are developed and revised under this rule.
- Plans would rely primarily on Forest Service directives for guidance on maintaining the viability of all species of conservation concern, as this is not explicitly required in the 1982 rule language.

Planning would allow more discretion 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. This allows for inconsistency in the use of this information 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.

Managing Ecological (Habitat) Conditions

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 (§219.19). 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. Although some plans require direct monitoring habitat conditions for MIS, it is not a requirement under the 1982 rule, and has been inconsistently incorporated into the monitoring programs in the original or revised plans. Habitat monitoring that is being accomplished might not be directly measuring compositional, structural, and functional based components at the appropriate scale to maintain viability for all vertebrates, let alone all species of plants and animals in the plan area.

Therefore, plans would continue to provide management direction for habitat management based upon the needs of selected MIS. Many MIS are not 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

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 and/or invertebrate 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 and seldom 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).

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. 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, is scientifically unsupportable. 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.

Therefore, 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.

Alternative C Effects

Maintaining Species Viability

Sections 219.8-Sustainability and 219.9-Species Diversity in this alternative set forth requirements relevant to providing for ecological sustainability and providing for diversity of plant and animal communities on national forests and grasslands.

The diversity of plant and animal communities provisions proposed under this alternative do not provide explicit requirements for plan components needed to meet 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 maintain species viability within the plan area.

Direction for how plans would be developed and what content would be required would be found in Agency directives.

Therefore, there would be considerable discretion for addressing 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. Thus, the ability for plan areas to maintain the diversity of plant and animal communities would be expected to vary across the NFS. Overall, plans would vary considerably in approaches to providing for diversity of plant and animal communities, which could lead to greater uncertainty regarding species viability on all NFS lands.

Managing Ecological (Habitat) Conditions

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 would vary among planning units across the NFS.

Therefore, there would be considerable discretion for addressing fish and wildlife habitat management because there are no specific requirements for how this 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 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 would be expected to vary across the NFS. 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

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, there would be considerable discretion on what would be in monitoring plans because there are no specific requirements. This 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 monitoring approaches for assessing the effectiveness of plan components necessary to provide the ecological conditions necessary to maintain the diversity of plant and animal communities. Planning would allow more discretion 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 utilizing other relevant information. This could lead to inconsistent use of this information 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 Viability

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

Section 219.9 provisions of the rule language, included within this alternative, require a complementary ecosystem diversity approach to maintaining the diversity of plant and animal communities in the plan area. These requirements direct plans to include components that essentially incorporate the coarse-filter/fine-filter strategies for maintaining species viability. The effects on maintaining species diversity within the plan area are similar to those disclosed under Alternative A (proposed action).

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. 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. This not explicitly stated and only implied under this alternative.

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, such as a small isolated population of white-tailed ptarmigan where, because of changing climatic conditions on the southern end of its range, a plan area might no longer provide the necessary habitat conditions they require to persist.

Therefore, 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). As in Alternative A, planning would recognize the need to coordinate conservation measures with other land managers for species of conservation concern 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 range-wide concerns of these species.

Managing Ecological (Habitat) Conditions

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 fully address resources affecting water quantity, quality, and flow; riparian area conservation; and aquatic habitat quality and connectivity.

The inclusion of these watershed requirements should add additional emphasis that would benefit aquatic and riparian resources. While requiring some or all of these plan components might 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, 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). Over time, as plans are implemented, the resulting plan areas are expected to yield habitat benefits, especially for aquatic and riparian species. Planning 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

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 language under this alternative relies 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. 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. This 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, plans would include ecological monitoring elements (ecological conditions, ecosystem characteristics, and focal species) that would 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.

Alternative E Effects

Maintaining Species Viability

Sections 219.8 and 219.9 are the same as the proposed rule (Alternative A). Therefore, 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 (proposed action). 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

Sections 219.8 and 219.9 are the same as the proposed rule (Alternative A). Therefore, effects would be the same as those described for Alternative A. Planning would assess ecosystem diversity characteristics (§ 219.6) and incorporate specific plan components that focus management activities on maintaining and restoring ecological conditions (§§ 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 protection and restoration measures for riparian areas. The implementation of these measures is expected to result in improved streamside, wetland, lakeside, and aquatic habitats, especially for aquatic and riparian species.

Monitoring to Assess Effectiveness

Section 219.12-Monitoring 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 proposed under this alternative go well beyond those required under any of the other alternatives in scope, scale, and specificity. 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-Requirements for Public Participation in this alternative provide 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 might not be the best fit in all situations.

Therefore, 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 either the need to change a plan or management activities in a more timely manner than under the other alternatives.

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 events, such as leaf unfolding, bird migration and egg laying and movement towards 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 altitude lakes and changes in range migration patterns of fish in rivers, are associated with rising water temperatures

[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.

and related effects such as changes in ice cover, oxygen levels and circulation (IPCC 2007).

Threats to Ecological Integrity

This section draws from the previous discussion about the Dynamic Nature of Ecosystems. Specific points from that section relevant to the climate change issue are:

- Ecosystems are delimited spatially in units exhibiting similar biological and physical patterns and at multiple scales.
- Ecosystems have changed and will continue to change over time. Therefore, ecosystems must be considered at different spatial and temporal scales.
- The structure and function of ecosystems are largely regulated along energy, moisture, nutrient, and disturbance gradients, which are strongly influenced by climate and other factors.
- As climate changes, the ecological units may change by shifting on the landscape or completely disappearing.
- A changing climate exacerbates the influence of other stressors, and cumulatively threatens to push ecosystems into fundamentally different ecological states, or even creating new combinations of stressors which have the potential to directly affect species, communities and ecosystems.

Additional information about the potential changes influenced by climate change is examined as follows.

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 last twenty 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 forests 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 and not in others.

The Climate Change Science Program (2008a) 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, advances in the timing of spring runoff and summer reductions of streamflow, and 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 cited in CCSP 2008a). 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 cited in CCSP 2008a). 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 cited in CCSP 2008a).

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 cited in CCSP 2008a). 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 cited in CCSP 2008a).

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 changes are 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 (Zisska 2003 in CCSP 2008a). Because many invasive species might benefit from climate change more than endemic species (Dukes and Mooney 1999 cited in CCSP 2008a), the structure, composition and function of ecosystems may be affected.

Threats to Social and Economic Conditions

Social and economic conditions may be affected by a changing physical and biological environment. Some examples from the literature of possible changes to social and economic conditions due to climate change are described below.

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, J. 2000). Winter recreation is likely to be affected by climate change, as might be the businesses associated with them.

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, D & Walls, M, 2009).

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 catastrophic 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, D & Walls, M, 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, C.L. et al, 2001).

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. Changes in water availability could affect the amount and timing of water available for agriculture, industry, or human consumption, especially in arid regions.

Uncertainties about Climate Change

This section draws from the previous discussion about the Dynamic Nature of Ecosystems. Specific points from that section relevant to the climate change issue are:

- For some aspects of climate, virtually all models agree on the same types of changes to be expected, e.g., heat index rising and increase in extreme precipitation events.
- For other aspects of climate, models disagree, e.g., the Canadian model and the Hadley model project different drought locations and intensities in the US.
- An adaptive management approach is useful for decisionmaking when high levels of uncertainty prevail.
- Passive or active adaptive management approaches should include;
  - recognition of the uncertainty,
  - an iterative process that involves decisionmaking, monitoring, and assessment, and
  - a collaborative effort to develop working relationships among managers, scientists, and the public.

The following discussion outlines some areas of convergence and divergence on climate change.

There is much we don't know about how the climate will change and how a changing climate will impact 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. Also, 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.

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, personal communication). 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. The ability of NFS lands to continue to serve as net carbon sinks rather than becoming net sources of emissions remains a matter of concern.

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). 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 identifies a need to develop climate change vulnerability assessments for the national forests and grasslands and to expand those assessments to include social impacts. Elements in the scorecard allow the agency to determine whether assessments are being developed in a way that will help inform decision-making at the unit level. The roadmap identified a need to improve the adaptive capacity on the land, and the scorecard

measures whether that process is underway at the unit level and is based on information from the vulnerability assessments. The roadmap identifies monitoring for the impacts of stressors and what resources are or will be most vulnerable to climate change. Adaptation strategies could be developed to address those vulnerabilities. Additionally, the scorecard measures whether those monitoring systems are in place and are being used to track climate change impacts and the effectiveness of management strategies.

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. While consideration of climate change is starting to be addressed during plan revisions, 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).

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 discussion on Ecosystem Restoration).

Alternative A (Proposed Action) Effects

To estimate the effects of climate change for various planning rule alternatives, the following questions are posed:

- Does the alternative have procedures or requirements concerning climate change and if so, what are they?
- How would plans address threats to ecological integrity and social and economic conditions influenced by climate change?
- How would plans address the uncertainties brought about by climate change?
- What are the expected conditions and trends over time from implementing plans?

Alternative A contains procedures and requirement to address climate change and they are:

- Plans would include components for ecosystem sustainability 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(a)(1)). In developing these components, the responsible official

would take into account the landscape scale of the ecosystems and system drivers, stressors, and disturbance regimes; their effect on ecosystem and watershed health and resilience; and the ability of the systems on the unit to adapt to change (§ 219.8(a)(1)(ii)). Plan components would also provide for the protection and recovery of threatened and endangered species (§ 219.9(b)(1)).

- 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. During plan development and revision, assessment, and the development of plan content, the potential impact of climate change along with other system drivers, stressors, and disturbance regimes such as wildland fire, invasive species, and human-induced stressors would be evaluated (§ 219.6(b)(1)).
- Monitoring questions and associated indicators would be designed to inform the management of resources on the unit by means such 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, 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. Also, 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 and that information would provide opportunities to amend plans more frequently than the current planning rule.

For social and economic conditions, it is expected that, through monitoring and assessment, plans 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.

Uncertainties of climate change would be addressed by a planning framework (§ 219.5) that has the necessary elements 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.

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

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. There are additional challenges for developing appropriate protocols and use and management of data collected at different scales. 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; the unit or broader 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.

Alternative B (No Action) Effects

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 non-native vertebrate species (§ 219.7);
- providing for tree diversity (§ 219.7); and
- estimating timber production capabilities.

Due to the 1982 planning rule requirements 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 Alternative A.

The 1982 planning rule does not have a planning framework designed for adaptive management, compared with Alternative A. As a result, opportunities to obtain information about reducing uncertainties of climate change would not be as available as Alternative A. 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.

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.

Only in recent years has there been an increased emphasis on the consideration of climate change in planning as described previously in the Affected Environment section on climate change. 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 Alternative A, D, or E—that climate change would be a consideration in the development, revision, and amendment of plans.

Alternative C Effects

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)).

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 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 Alternative A. 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 Alternatives A.

As previously described in the Affected Environment section on climate change, many of the approaches suggested for climate change are already part 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 whether or not the results of such analysis would be used to develop, revise, or amend plans.

Alternative D Effects

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 non-native 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 historic 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)).

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 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.

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.

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 the necessary elements 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.

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.

Alternative E Effects

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.

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. 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)).

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 and more opportunities for a rapid response to climate change through plan amendments than Alternative A.

There would be some operational challenges for monitoring requirements in addition to those cited for Alternative A. Additional monitoring requirements could lengthen the planning process. Extra time is expected to reach agreements on signal points, or thresholds before a plan could be approved.

MULTIPLE USES

National Forest System lands contribute to community economic and social sustainability by providing multiple-use goods and services. The national forests and grasslands also contribute to vibrant communities by delivering a tremendous number of ecosystem services, ranging from water delivery, to 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 hold 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 downhill skiing in this country. Another example—one from medicinal values—Pacific yews harvested from the Gifford Pinchot National Forest in the early 1990s yielded the first taxol, which is 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 like 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, pollinate crops, and provide aesthetic, spiritual, and cultural values.

It is recognized that ecosystem services have considerable value that contribute to sustainable communities. Since ecosystem services are outcomes of providing for healthy ecosystems, for the purposes of this analysis, the discussion of alternatives relevant to ecosystems are found in the Ecosystem Restoration, Watershed Protection, and Diversity of Plant and Animal Communities sections of this document.

Some people who commented on the proposed planning rule urged the Agency to not forget 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 three uses are discussed in this section. Effects of the alternative planning rules on management of the other multiple uses in the MUSYA (i.e., watershed, wildlife, and fish purposes) 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. 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 demand for geothermal, wind, and solar energy development on NFS lands. Management of the renewable resources mandated by MUSYA recognizes ongoing and potential exploration and development while protecting and conserving these resources.

Affected Environment

Outdoor Recreation

The management of recreation settings 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. According to monitoring data, 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 two 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 strongly 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 (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 three 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 and 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 over 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 U.S., and this has implications for forest planning and management. While there are counties with more in-migration (e.g. retirement destination counties), national forest counties have experienced more population growth (19% as compared to 13 percent nationwide) (Johnson and Stewart 2007). This in-migration is largely amenity based and could change the local context for forest planning.

The ethnic makeup of nearby populations leads to varying interests and recreational needs as well as varying experiences with barriers to participating in recreation on national forests. 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.

The nation will be more racially and ethnically diverse by midcentury, 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, single-race white population is projected to be only slightly larger in 2050 than in 2008. In fact, this group is projected to lose 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 impact 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). Forests, 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 (Appendix C § 219.21) include:

- 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 National Forest System lands.

A few 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 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 are 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 tradeoffs (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.

Another tool is the recreation facility analysis, a process used to assist NFS units in creating a fiscally sustainable recreation program. The analysis includes developing a unit recreation niche statement that helps create a sustainable recreation program. The recreation niche identifies those elements that are valued in a landscape by people to be sustained in the future. The analysis responds to the 1982 planning rule requirements to discuss the supply and adequacy of facilities to meet present and future demands. 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. Recreation was discussed in the environmental impact statements associated with the land management plan reviewed 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 2010 Framework for Sustainable Recreation is a new strategy that will strive 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 adapt 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 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 field presence to provide quality recreation experiences while reducing the impacts of visitor use on the landscape.

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 matures, 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 National Forest System 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 stakeholder 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 as well as by other resource values such as wildlife needs. 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 (Figures 2, 3, 4), wildlife habitat, water, minerals, energy, recreational opportunities, and even some wood products. 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 three graphs 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.)

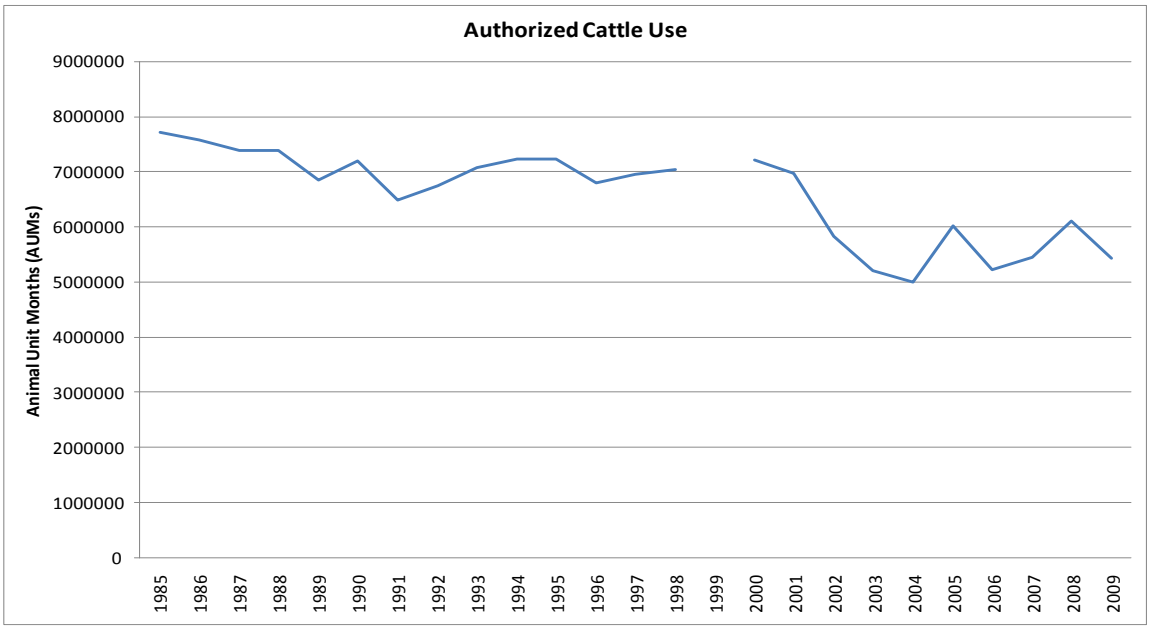

Figure 3. Authorized Cattle Use.

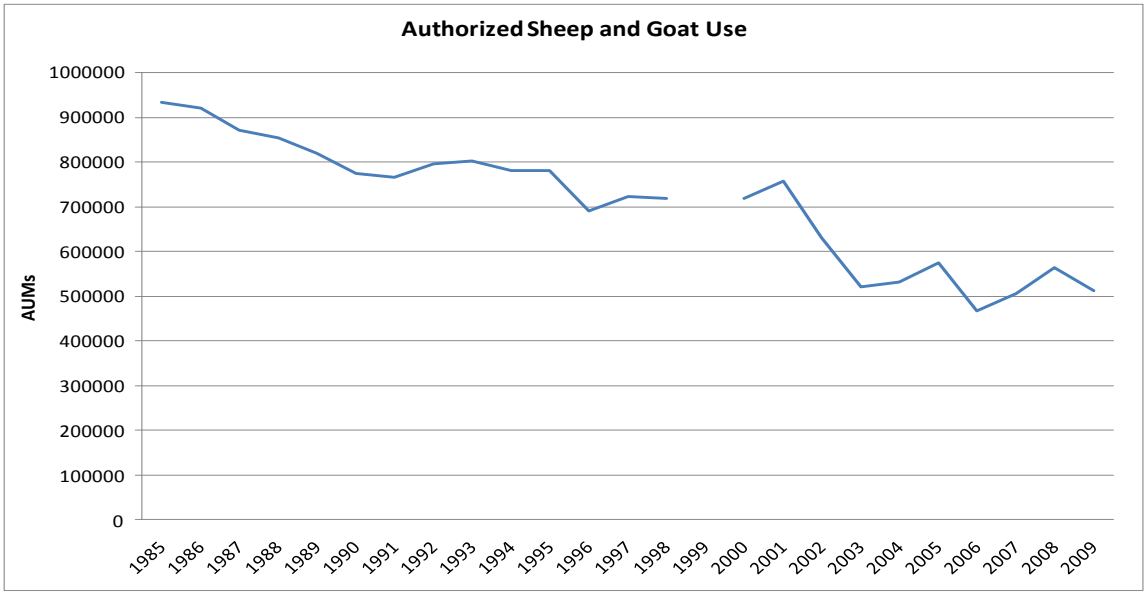

Figure 4. Authorized Sheep and Goat Use.

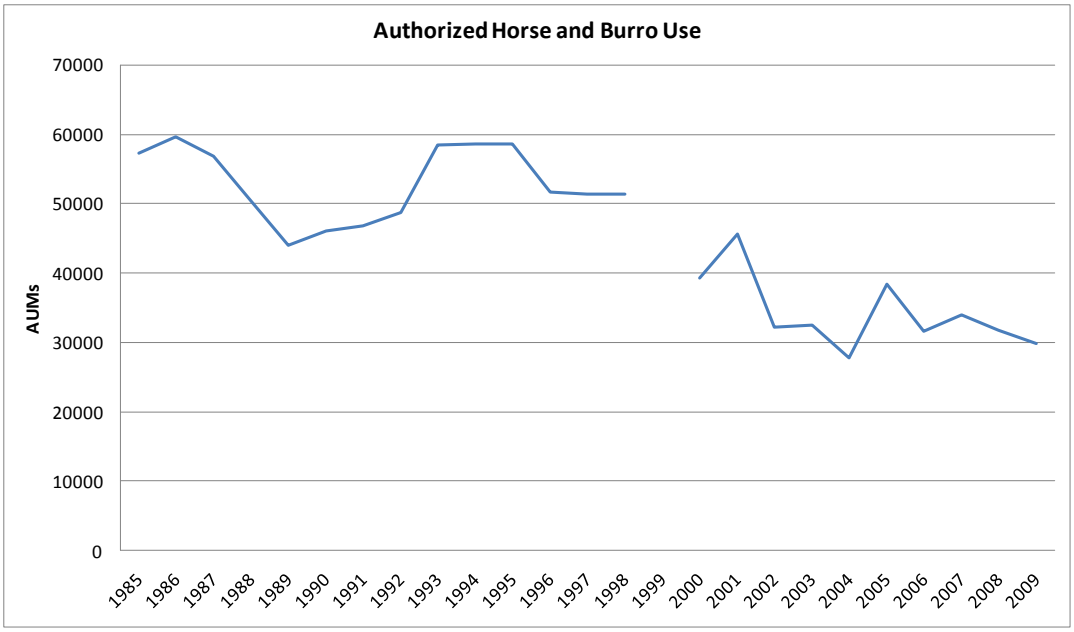

Figure 5. Authorized Horse and Burro Use.

Livestock grazing on NFS lands contributes to an estimated 3,695 jobs and labor income totaling $91.9 million (See Appendix J). 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).

Little is known about the size, distribution, and types of rangeland occupied by private ranches having Federal grazing permits or leases, or about the beliefs and attitudes of public lands grazers. Some observers, however, 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. Although research has shown that ranchers would not want to sell their ranches if they lost their grazing privileges, 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). 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 km 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 one km 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. 2010). Decisions with future undesirable consequences might be preferable to decisions with undesirable consequences today. Sustainable rangeland management on NFS lands requires attention to potential economic influences facing grazing permittees.

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 due to 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/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 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% 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 (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 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 depends on range resources for their livelihood. (See 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 or *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 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.

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). Forest management objectives have since expanded and evolved to 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 J.)

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. This illustrates the trend away from timber-purpose sales and toward using timber harvest as a management tool to achieve other resource benefits (Figure 5).

National forest timber sales can 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.

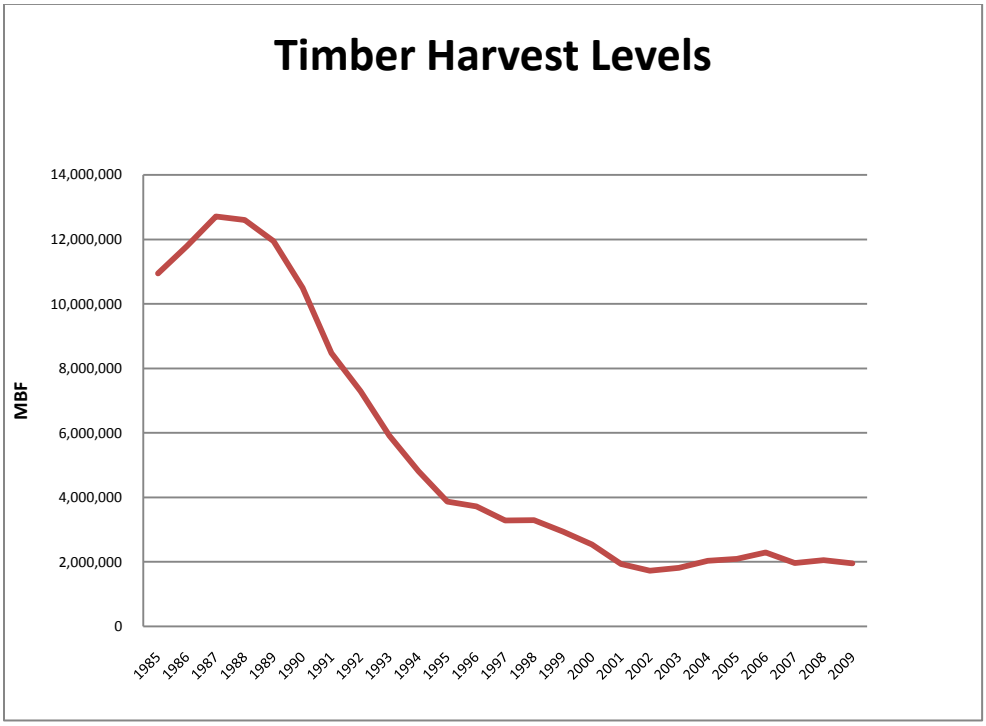

Figure 6. Timber Harvest Levels.

Figure 6 shows the decrease in volume harvested from NFS lands between 1988 and the present. The data included in Figure 6 comes 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 in economic support of local communities and U.S. wood consumers. During that time demands for other uses and values of NFS lands increased dramatically. Since 1982, there has been a shift in planning focus to restoring and maintaining healthy ecological conditions and meeting the recreational and amenity preferences of local and national stakeholders. 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 now provides less than five 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 7). There have also been corresponding increases in lumber imports, mostly from Canada (MacCleery 2008).

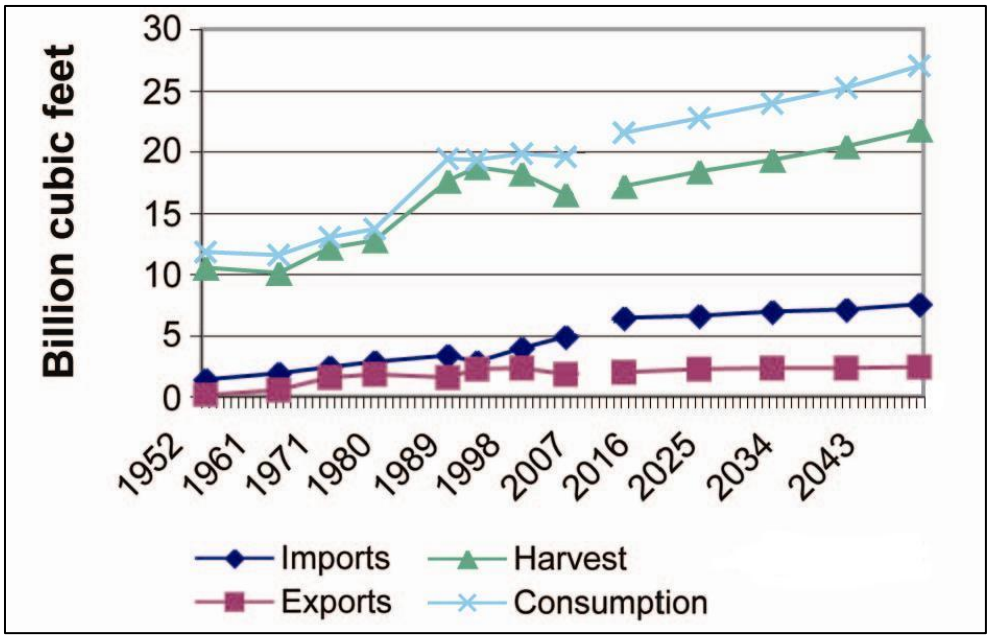

Figure 7. Timber Production and Consumption in the United States. (USDA Forest Service 2007c)

Administrative appeals and lawsuits charging that the Forest Service is violating NEPA, NFMA, the Endangered Species Act, and other environmental laws have become common and are successful often enough to delay some proposed timber sales and other projects and create uncertainty over national forest timber and other commodity program outputs (Fedkiw 1999).

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 currently involve 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 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)).

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.

Alternative A (Proposed Action) Effects

Outdoor Recreation

The proposed rule 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.

The proposed rule 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.

Under the proposed rule, 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). The proposed rule 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 would assure consideration of a full spectrum of recreational uses and values relevant to each NFS unit.

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 reflect an integrated mix of recreational opportunities complimenting those of the local area and within the capability of the unit.

Plans would provide for protection of wilderness areas as well as the protection of recommended wilderness areas 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 Agency policy described under the Affected Environment section and, therefore, would not change as a result of the proposed rule.

Once revised, 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)). The proposed rule would bring more consistency to plan monitoring programs across the NFS than under current rule procedures (Alternative B) and increase the probability of plans being responsive to changes in recreation values and use trends.

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, it would also contribute to the other multiple uses and ecosystem services that provide benefits to communities.

Range

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 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)). 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 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 decisions and their attendant effects would be analyzed at the site-specific, project level.

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 ecologic, 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 this rule would, over time, evaluate the effectiveness of management strategies for restoration and protection of healthy rangelands.

Timber

With a few exceptions, the substantive and procedural direction in the proposed rule (Alternative A) is consistent with the direction in the current rule procedures (Alternative B) with respect to the forest management program and timber. The NFMA requirements related to timber production, found in the current rule procedures (§§ 219.14, 219.16, and 219.27) are combined in one section in the proposed rule (§ 219.11). Other relevant sections of the current rule procedures and proposed rule are comparable as follows:

- The current rule procedures require 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)). The proposed rule 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)). The current rule procedures require identification of lands suitable and not suitable for timber production (§ 219.14(a)). The proposed rule would require identification of areas not suited for timber production (§ 219.11(a).
- The current rule procedures require 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). The proposed rule 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)).

Under the proposed rule's emphasis on ecosystem sustainability, plans 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

(§ 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.

Alternative B (No Action) Effects

Outdoor Recreation

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. 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

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

Land management plans and the forest management program 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

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 up 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. 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

As in 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

Without additional prescriptive requirements, timber direction in plans under this alternative 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. Consequently, 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

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)). 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, existing facilities could be subject to a range of mitigation measures such as upsizing culverts on roads, hardening recreation sites with gravel, decommissioning roads, and moving recreation sites outside of riparian areas. 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. Recreation would be addressed in assessments, throughout the plan content and in monitoring the same as it would in Alternative A.

Range

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). Where riparian restoration is needed and livestock grazing is identified as a stressor, allotment management plans would be expected to be modified (e.g., numbers, season of use, or additional investments in livestock water sources) at least until the riparian area is restored to proper functioning condition. In general, there is potential for case-by-case temporary or permanent reductions in authorized livestock use. However, such decisions and their attendant effects would be analyzed at the site-specific, project level.

Timber

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)). These 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

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)). The assumption is that 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.

Range

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.

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 from those described for timber under Alternative A.

EFFICIENCY AND EFFECTIVENESS

Affected Environment

The scope of this analysis is limited to the programmatic or Agency procedural activities related to development, revision, and amendment (i.e., maintenance) of land management plans for management units (e.g., national forests, grasslands, and prairies) within the NFS. As such, Agency or private costs or 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 Cost-Benefit Analysis prepared for the proposed planning rule (USDA Forest Service 2011).

Differences in 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 a need for change prior to initiating plan revisions or amendments, pre-NOI);
- Collaboration (e.g., collaboration and public engagement activities *outside* of public comment solicitation and content analysis completed to satisfy NEPA requirements);
- Development and analysis of plan revision and amendment decisions (i.e., development of alternatives to address need for change; analysis and

comparison of the effects of alternatives; and finalizing and documenting revision and amendment decisions);

- Science support (i.e., activities for assuring consideration of the best available scientific information);
- Monitoring (limited to those monitoring activities that support planning); and
- Resolution of disputes about the proposed plan decisions through the administrative processes of appeals or objections.

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 and then used as a baseline from which adjustments are made, based on explicit differences in planning procedures, to estimate costs for the proposed rule and 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 (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 sustains multiple uses (including ecosystem services) 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 years under the proposed rule and 5 years under the current procedures, implying plan maintenance or amendment would be occurring for the remaining 12 and 10 years respectively. 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 8 illustrates these budget trends since 1995.

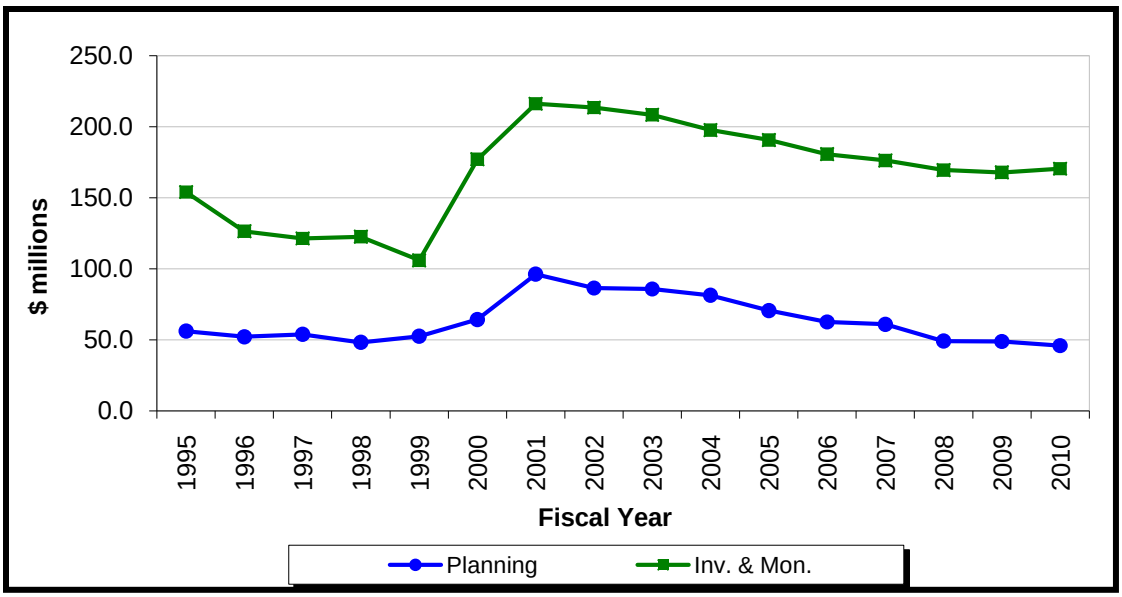

Figure 8. Planning, Inventory, and Monitoring Budget Trends.

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 the 1982 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. 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 noted below:

Collaboration: Costs for collaboration are assumed to cover all collaboration activities and public meetings, except activities related to public comments and content analysis for complying with NEPA and NFMA formal notification and comment solicitation requirements (those costs are included within the Analysis/Revision section). Costs for collaboration under the proposed rule include all costs under the current rule procedures and also include estimates of expenses for additional collaboration involvement, training, facilitation, tribal involvement, facilities, and travel (USDA Forest Service 2010g). Collaboration costs account for 21percent of plan revision costs under the proposed rule. Collaboration accounts for 5 percent of projected costs during plan maintenance periods under the proposed rule.

Science Support: Costs for science support include expenses for consultations and other activities to help take into account best available scientific information and provide documentation in assessment reports, plan decision documents, and monitoring

evaluation reports. Science costs under the proposed rule are approximately 3 percent, consistent with percentages described in previous assessments of planning rule costs (USDA Forest Service 2002a, 2007b). Science support costs decrease to less than 1 percent of total costs during plan maintenance periods.

Assessments: Under the proposed rule, assessment costs include activities related to a number of pre-NOI activities such as assessments of current conditions and trends, and viability assessments. Assessment costs are estimated to account for 19 percent of plan revision costs. Assessment cost percentage during plan maintenance periods decrease to approximately 8 percent.

Analysis/Decisions: These costs primarily cover post-NOI NEPA-related activities including effects analysis, public comment solicitation and content analysis, and alternative development. Costs also include timber (suitability) analysis requirements, comparison of alternatives, and documentation of decisions. Projected analysis and decision costs account for 37 percent of plan revision costs under the proposed rule. Analysis and decision costs during plan maintenance are estimated to decrease to 14 percent.

Resolutions: Costs to address post-decisional appeals and pre-decisional objections account for 3 percent and 2 percent of plan revision costs, respectively. Resolution costs are estimated to account for less than 1 percent of costs during plan maintenance periods.

Monitoring: Historical expense and budget allocation data indicate that annual monitoring costs during plan revision and plan maintenance are similar. Monitoring costs during plan revision are estimated to be 21 percent of non-monitoring costs, while monitoring accounts for 60 percent of plan maintenance costs.

The annual cost to the Agency for all planning-related activities under the proposed rule ($102 million per year) is estimated to be $1.5 million per year lower compared to current rule procedures ($104 million per year). Annual Agency cost estimates assume the number of plans in revision in a given year would be the same across all alternatives (Table 5).

As indicated in Table 6, 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 this alternative, due in part to the reduced number of years anticipated to be needed for plan revisions. Time (and therefore costs) needed to complete plan revisions is assumed to decrease under this alternative 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).

Table 5. Estimated Average Annual Agency Costs (For All Units in $1,000 Per Year)

Planning Activity	Proposed Rule Alternative A	1982 Rule Procedures Alternative B	Alternative C	Alternative D	Alternative E
Assessment	$12,627	$8,744	$6,558	$14,521	$12,627
Collaboration	$10,608	$1,213	$1,213	$10,608	$14,321
Analysis/Decisions	$22,080	$49,350	$33,120	$24,288	$22,080
Science Support	$2,160	$1,563	$1,563	$2,160	$2,160
Resolutions	$920	$2,150	$2,150	$920	$920
Minimum Maintenance (a)	$7,260	$4,914	$4,914	$7,260	$7,260
Monitoring	$46,864	$36,113	$30,696	$56,237	$74,982
TOTAL	**$102,519**	**$104,048**	**$80,214**	**$115,994**	**$134,350**

(a) Minimum maintenance includes minimum expenses to maintain a plan during non-revision years, excluding assessment, collaboration, and analysis/decision costs associated specifically with amendments.

Table 6. Net Cost Change From Current Rule Procedures (For All Units in $1,000 Per Year)

Planning Activity	Proposed Rule Alternative A	Alternative C	Alternative D	Alternative E
Assessment	$3,883	($2,186)	$5,777	$3,883
Collaboration	$9,395	$0	$9,395	$13,107
Analysis/Decisions	($27,270)	($16,230)	($25,062)	($27,270)
Science Support	$597	$0	$597	$597
Resolutions	($1,230)	$0	($1,230)	($1,230)
Minimum Maintenance (a)	$2,346	$0	$2,346	$2,346
Monitoring	$10,751	($5,417)	$20,123	$38,869
TOTAL	**($1,528)**	**($23,833)**	**$11,946**	**$30,302**

(a) Minimum maintenance includes minimum expenses to maintain a plan during non-revision years, excluding assessment, collaboration, and analysis/decision costs associated specifically with amendments.

Alternative A Effects

The proposed rule entails procedural changes and reallocation of effort across key planning activities. 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 under the proposed rule. These shifts in emphasis and resources also help plans remain current and improve the 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, stakeholders, and other 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 outputs and outcomes related to unit contributions to ecological, social, and economic conditions require need for change; and (3) responding to need for change through management activities and projects or revisions and amendments to plan components.

Assessments: Compared to current procedures, the following assessment requirements and guidance are expected to improve capacity to assimilate and integrate new information for determining need for change:

- Assessments are to be conducted at landscape levels and at a geographic scale based on ecological, economic, or social factors, rather than strict adherence

to administrative boundaries, thereby enhancing capacity to incorporate information about conditions outside of NFS boundaries.

- Risks and vulnerabilities to ecosystem sustainability 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).
- Agency costs for assessments could be offset in part by considering and referencing existing assessments completed by States and other entities.

Collaboration: Costs associated with collaboration are projected to increase under the proposed rule due primarily to requirements that opportunities for collaboration be provided at all stages of planning. Gains in cost effectiveness 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. Collaboration costs for some units could be higher where potential barriers to collaboration are present (e.g., pre-existing relationships could exacerbate perceived inequities; some locations might have an absence of pre-existing social networks or capacity). Changes in guidance and requirements for collaboration under the proposed rule are expected to increase planning efficiency as a result of the following:

- Improved capacity to address 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 analysis and decisionmaking efficiency during latter stages of planning due to increases in collaborative efforts during early phases (e.g., assessments);
- Potential to offset or reduce Agency monitoring costs 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;
- Improved perceptions about the legitimacy of plans and the planning process and reduced Agency costs associated with resolving objections (or conflict) by increasing transparency, developing awareness about the values and expected behavior of others, and seeking greater consensus about values, needs, tradeoffs, and outcomes during earlier stages of planning; and
- Expectations about building unit (and regional) capacity to overcome existing barriers to collaboration through training and facilitation.

Analysis and Decisions (Plan Revision or Amendment)*:* Costs associated with analysis and decisions are estimated to decrease under the proposed rule owing to: (1) fewer prescriptive requirements (relative to current rule procedures) regarding probable (management) actions, timber program elements, number and types of alternatives,

evaluation of alternatives, and minimum management requirements; (2) increased emphasis on consideration of resource attributes and conditions such as sustainability, watershed health, and water supply; and (3) more efficient approaches for addressing species viability and diversity. The following elements associated with the proposed rule are expected to increase planning efficiency by facilitating plan revisions and amendments, increasing capacity for adaptive management, and improving guidance for responding to need-for-change determinations:

- The adoption of a coarse-filter/fine-filter approach for addressing species viability and diversity, combined with the recognition that there are jurisdictional and resource limits that constrain the levels of viability and diversity that might be considered achievable, is expected to make it easier for management units to develop plans that provide feasible or realistic direction for responding to species and ecosystem sustainability and recovery needs.
- More frequent amendments expected under the proposed rule could potentially lead to more focused descriptions of need for change to guide future revisions.
- Greater emphasis placed on identifying each unit's role in providing ecosystem services within a broader landscape or region should facilitate the design of management responses that recognize the marginal effects or contributions of ecological, social, or economic conditions outside the traditional unit study area boundaries.
- Less prescriptive descriptions of timber harvests, sale schedule, and management practices under the proposed rule would be expected to provide the flexibility needed to develop actions that are responsive to unit-specific vegetation management and ecosystem restoration (sustainability) needs.

Science Support*:* Slight increases in costs for science support might occur under the proposed rule in part because of more prescriptive language about taking into account best available scientific information in assessment reports, plan decision documents, and monitoring evaluation reports. The guidance and requirements for use of science under the proposed rule 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.

Resolutions*:* The effect of a shift from what has been largely a post-decisional appeals process to a pre-decisional objection period under the proposed rule is difficult to project; however, the anticipated success of collaboration in achieving greater understanding about plan components and perceptions of legitimacy and trust in the planning process is expected to have a beneficial effect on resolution activity and corresponding costs. Procedural changes related to collaboration are expected to provide opportunities for resolving potential objections or conflict at earlier stages of planning, thereby reducing the need for and cost of resolutions at latter stages.

Monitoring*:* Relative increases in monitoring costs are anticipated as a consequence of greater emphasis on broader input and participation in design and implementation of monitoring, adjustments to new requirements for characterizing diversity and resilience, and two-tier (unit-specific and broad-scale) monitoring programs. Monitoring requirements, such as coordination of broad-scale monitoring, as well as adoption of "focal species" and key ecological conditions as measures for diversity, rather than a species-by-species approach, are expected to contribute to monitoring cost-effectiveness.

This alternative includes requirements for plans to include monitoring questions related to the status of watershed conditions, ecological conditions, focal species, visitor use, climate change influences, carbon storage, contributions to ecological, social, and economic conditions, and effects of management systems on the productivity of the land (§ 219.12(a)(5)). This specificity of monitoring requirements, along with a requirement to evaluate this information every two years (§ 219.12(d)) would validate the currency of plan direction or identify a need to change a plan. It is expected that plans would be routinely amended under this alternative, to fine tune plan components in response to changing conditions.

The following changes in guidance and requirements for monitoring under the proposed rule are expected to increase planning efficiency by improving capacity to gather information and reduce uncertainty for a number of integrated ecological, social, and economic conditions, trends, risks, stressors, constraints, and values, within and beyond unit boundaries:

- Monitoring under the proposed rule focuses to a greater extent on ecosystems, habitat diversity, and smaller numbers of focal species, with the intent that tracking of species diversity and habitat sustainability would be more cost effective and reflective of unit-specific capacities compared to current rule procedures.
- Two-tiered monitoring (unit-specific and broad-scale) is intended to create a more systematic and unified monitoring approach to detect effects of management within unit boundaries as well as to track risks, stressors, and conditions beyond unit boundaries that affect or are affected by unit conditions and actions.
- Emphasis on coordination between unit and broad-scale monitoring helps ensure information is complementary and gathered at scales appropriate to monitoring questions, thereby reducing redundancy and improving cost-effectiveness.

Alternative B Effects

Estimates of planning and monitoring costs during plan revision years, as well as distributions of costs across key planning activities (e.g., assessment, analysis, appeal resolution, etc.) under this alternative are based initially on past cost estimates for plan revision under the 1982 rule procedures (USDA Forest Service 2007b) and then adjusted to reflect recent information and data obtained regarding Forest Service paid expenditures (USDA Forest Service 2010a) and Forest Service budget allocations for planning and

monitoring activities (USDA Forest Service 2010c, 2010b), as represented by Agency budget line items for planning (NFPN) and monitoring (NFIM) for 1996 to 2010.

As illustrated in Table 5 (earlier), the annual planning cost to the Agency under Alternative B is estimated to be $104 million per year.

Historical expenditures and funding allocations (USDA Forest Service 2010a, 2010b) were examined to help derive planning costs during maintenance periods. Historical data suggest that annual expenditures per management unit associated with the non-monitoring planning activities (i.e., budget line item NFPN) during maintenance years are about 30 percent of annual expenditures during periods of revision. Based on final cost estimates for this analysis, average annual costs associated with non-monitoring planning activities for plan maintenance are approximately 35 percent of non-monitoring planning activities during plan revision. Additional details about cost assumptions and estimation for key activity categories are noted below:

Collaboration: The costs for the current rule procedures during periods of revision are based on the cost of traditional public meetings and minimal amounts of additional collaboration; costs during maintenance periods are assumed to be negligible (zero costs) relative to other planning expenses. Collaboration costs account for approximately 3 percent of plan revision costs under this alternative.

Science Support: Costs for science support under this alternative are approximately 3 percent of plan revision costs, consistent with percentages described in previous assessments of planning rule costs (USDA Forest Service 2002a, 2007b). Science support costs decrease to less than 1 percent of total costs during plan maintenance periods.

Assessments: Assessment costs (pre-NOI) include activities related to assessments of current conditions and trends (e.g., analyses of management situations (AMS) and benchmark analysis). Assessment costs were estimated to account for 9 percent of plan revision costs under this alternative.

Analysis/Decisions: These costs cover primarily post-NOI NEPA-related activities including effects analysis, public comment solicitation and content analysis, and alternative development. Costs also include timber (suitability) analysis requirements, comparison of alternatives, and documentation of decisions. Projected analysis and decision costs account for 47 percent of plan revision costs. Analysis and decision costs during plan maintenance are estimated to decrease to 33 percent.

Resolutions: Costs to address post-decisional appeals under and pre-decisional objections account for 3 percent and 2 percent of plan revision costs respectively. These percentages are similar to those reported in previous planning cost analyses (USDA Forest Service 2002a, 2007b). Resolution costs are estimated to account for less than 1.5 percent of costs during plan maintenance periods.

Monitoring: Monitoring costs are assumed to be represented by funds and expenses under the Agency's NFIM budget line item. Historical expense and budget allocation data indicate that annual monitoring costs during plan revision and plan maintenance are similar and that monitoring funds directed toward planning range from 40 percent to 57

percent of non-monitoring funds (i.e., budget line item NFPN) for planning (USDA Forest Service 2002b, 2010a, 2010b).

As evidenced in other sections of this statement, some recently revised plans incorporate concepts, if not actual requirements of the proposed rule 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 much consistency across NFS units.

Alternative C Effects

As indicated in Table 5 and Table 6 (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 Table 5 and Table 6, 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 the proposed rule (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 the proposed rule (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. Unlike any of the other alternatives, an environmental impact statement would not be required for plan development or revision. This means that 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). The science review and documentation requirements under the proposed rule are no longer prescribed under Alternative C, so science support costs are assumed to be similar to costs estimated for the 1982 rule procedures, recognizing 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).

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 the 1982 rule procedures.

Prescriptive requirements regarding monitoring under the proposed rule, as well as the 1982 rule procedures, are removed under Alternative C. Monitoring costs are therefore assumed to be equivalent to 1982 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 the 1982 procedures. These additional cost deductions are estimated to be approximately 15 percent of baseline 1982 rule procedure monitoring costs based on past analyses[5].

Prescriptive requirements regarding assessments under the proposed rule are removed, and it is assumed that other requirements under the 1982 rule procedures would likewise not apply (e.g., requirements associated with analyses of management situations (AMS), benchmark analyses, regional guides, and evaluations of MIS). As a consequence, assessment costs under Alternative C are projected to be 25 percent lower relative to assessment costs estimated for the 1982 rule procedures based on reduced numbers of monitoring requirements, continuing need to perform assessments to determine need for change, and assumptions regarding percent reductions for monitoring costs.

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 the 1982 rule procedures and the proposed rule would not apply. Plan components and NFMA timber requirements under the proposed rule would remain in effect under Alternative C, as would most requirements to consider sustainability, climate, diversity, and restoration; however, much of the prescriptive language for considering these factors is removed under Alternative C. Given the absence of 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 the proposed rule. Analysis and decision costs under Alternative C are therefore assumed to be significantly lower than costs under the 1982 rule procedures, but more than analysis costs projected under the proposed rule by 50 percent.

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[4] 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.

[5] 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).

There is potential for costs associated with resolving objections under Alternative C to increase relative to the proposed rule as well as the 1982 rule procedures; 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 the 1982 rule procedures.

Under Alternative C, most of the 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 under Alternative A would be eliminated. Agency costs are substantially lower as a consequence of these changes. 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 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 recognize these needs and increase Agency as well as unit capacity for adapting management plans to new and evolving information about risks, stressors, contingencies, and management constraints, as described in the section above. In the absence of this prescriptive direction, it is anticipated that management units would have less capacity 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 capacity 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 decrease because of the inability of management units to 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 5 and Table 6 (earlier), 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 the proposed rule (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 increases in 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. 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; 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 the proposed rule (Alternative A). Successful coordination could also provide increased opportunities to distribute and share monitoring and assessment costs as well as more cost-effective monitoring strategies. More prescriptive requirements regarding utilization of best available scientific information under Alternative D could slightly increase costs associated with the "science support" activity category. However, similar support could be called for under Alternative A. Therefore, overall increases in Agency costs for science support 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 a 15 percent increase in assessment costs, 10 percent increase in analysis costs, and 20 percent increase in monitoring costs, compared to Alternative A. As a result of these changes, 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 the proposed rule (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.

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 could increase Agency costs 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 uncertainty about changes in plan revision time and variability in unit-specific conditions related to 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

As indicated in Table 5 and Table 6 (earlier), 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 decrease under these alternatives 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 E can be considered to be a modification of the proposed rule (Alternative A) in that prescriptive requirements for assessment, monitoring, and collaboration are augmented. As such, changes in Agency costs for these alternatives are described, by planning activity, as qualitative or percent changes with respect to Alternative A.

Alternative E would require consideration of possible scenarios in assessments for plan revision. This approach would have short-term cost increases with possible long-term gains in efficiency. Any potential improvements in planning efficiency would rely on agency personnel gaining substantial training, experience, and wisdom about how to conduct scenario planning. The level of development of skills not commonly found in the Agency would add short-term cost and effort to transition periods as forests start to apply scenario planning. Because scenario planning is "story like" it is a natural way for people to talk about possible futures and alternative responses to different circumstances. Some other agencies, such as National Institutes of Health, Centers for Disease Control, and Department of Defense, have processes for scenario planning that are accepted as effective approaches to communicating and analyzing possible futures where there is a high degree of uncertainty.

Because of a lack of scientific evidence providing projections in land management conditions and trends such as vegetation community changes, wildlife population dynamics, and social pressures, a diverse group of people engaged in describing several alternative scenarios might have difficulty agreeing on a few scenarios and possible alternate responses. This could prolong a process for developing and discussing scenarios and leave some reasonable scenarios unaddressed. Moreover, the incompleteness of climatic models is problematic (e.g. not all models account for variations in earth-based conditions such a soil types, geology, vegetation, elevation). Many models fall far short of including information about ground conditions because they rely more heavily on atmospheric conditions (e.g. temperature, precipitation, and movement and concentration levels of gaseous elements).

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 new 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 the proposed rule 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 the proposed rule and $30 million per year (29 percent) higher than the current rule procedures.

New prescriptive requirements regarding monitoring program questions, monitoring indicators, and program performance under Alternative E could contribute to improvements in the consistency of monitoring program reliability, recognizing 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 are achieved by incurring additional costs (Agency costs are 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 the proposed rule (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. 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.

Similar to Alternative D, isolated improvements in planning efficiency for some units could result from more explicit requirements about signals for monitoring questions, factors to consider in monitoring questions, periodic evaluations of monitoring programs, and the process for developing a strategy for public participation (collaboration) under Alternative E, but 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 uncertainty about changes in plan revision time and variability in unit-specific conditions related to 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 2002, 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 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 2002, 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 2002, Johnson et al. 2003, Lasker and Weiss 2006, 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 (Office of Management and Budget 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).

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 2002; 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 (Selin 2007). 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.

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 conflict and

conclusions associated with established scientific or technical knowledge (Rossi 1997, Wondolleck and Yaffee 2000). Others have raised concerns about the potential for coercion, agency capture or clientelism, power imbalances, false commitment to the process, artificial empowerment, perverse disempowerment, or unmerited confidence in the support of the eventual decision, among many others (Ansell and Gash 2008, Cooke and Kothari 2001, Williams 2006).

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).

Existing provisions for public participation rely 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 new plan or plan revision. (Public participation in plan amendments varies with the nature and complexity of the proposed amendment.) First, a notice of intent (NOI) to prepare an environmental impact statement for the development of a plan or plan revision is published in the *Federal Register*. Public comments are used to establish the scope of the analysis to follow. The Agency then publishes a draft environmental impact statement and a draft 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 public comment by publishing a proposed plan for comment prior to preparing a draft environmental impact statement.

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 (§ 219.6(d)). At several places in the existing rule provisions, public participation is encouraged as deemed appropriate by the responsible line officer.

Currently, approval of new land management plans and plans revisions must be made by a regional forester. This means that 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 has historically acted as the regional forester's representative in public involvement activities and for purposes of approving significant issues and alternatives to be analyzed. Compared to the forest or grassland supervisor, the regional forester is less likely 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 decision maker.

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. Appeals and 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, decision maker, 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 was issued in 1983[6], public participation has varied from units providing formal notice and comment opportunities at the required NEPA phases to more robust engagement of the public at numerous stages of the planning process. Outreach methods have ranged from the minimum of publishing an NOI and draft environmental impact statement, to 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 public outreach and involvement in planning to become increasingly more extensive. Many of the current plan revision processes are actively engaging the public throughout the planning process —much more so than was undertaken in earlier plan development or revision efforts.

To get a sense of the scope and variation in recent public involvement efforts, some of the more recent plan revisions were reviewed. 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 requirements. Despite the lack of a formal requirement in the current planning regulations, the trend has been for recent plan revisions to increasingly engage collaborative groups in the planning process. In the eight recent revisions reviewed for this analysis, four used collaborative groups of some manner. Some 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

[6] The first forest plan under the 1982 rule was the Black Hills Plan in 1983.

revision documents have been made available through the Web. Indeed, eight out of eight recent plan revisions reviewed for public involvement practices made their draft and final plans and associated documents available on the Internet.

As evidenced by the diversity of public involvement strategies used over the past three decades of land management planning, the existing regulations 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 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) 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. Accordingly, 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.

Alternative A (Proposed Action) Effects

Under Alternative A, the responsible official would provide opportunities for all stakeholders 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 DEIS 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 the results 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, but also encourage participation by youth and low-income and minority populations, who have traditionally been underrepresented in the planning process (§ 219.4(b)). Existing "best-practices" of engaging a broad diversity of public interests would be institutionalized, thereby ensuring more consistency in planning efforts across NFS units. 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 currently required formal 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 plans adequately reflect traditional tribal knowledge.

Under this alternative people 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 forest or grassland supervisor would be the responsible official (§ 219.2(b)(3)). Throughout the various public engagement activities discussed above, interested and affected parties would have the advantage of being able to interact directly

with the decision maker. The direct interaction of the decision maker and stakeholders throughout the planning process is expected to enhance collaboration and help produce plans that more accurately reflect 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.

Alternative A would institute a pre-decisional objection process as the sole means to administratively challenge a plan decision (§ 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, decision maker, 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. 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 create consistency in how the administrative challenge process works across all NFS units. This would be a change from the current regulations, in which some units might use the post-decisional, administrative review process, while others might use the 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)).

Alternative B (No Action) 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 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 only meet the minimum requirements and people traditionally not involved in the planning process could be overlooked. Consequently, it is expected that the process would 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 only require opportunities for public involvement two times during the plan development process: (1) during scoping for development of the DEIS and (2) during required public comment periods for the DEIS and proposed plan.

Under this alternative, approval of new land management plans and plans revisions is made by a regional forester. 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 act as the regional forester's representative in public involvement activities and for purposes of approving significant issues and alternatives to be analyzed. Compared to the forest or grassland supervisor, the regional forester is less likely 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.

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 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 decision maker 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 the proposed rule (Alternative 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 that need to be involved;
- Work with the stakeholder 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 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 2002; 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, the sense that the process was fair. 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 stakeholders, 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).

As in Alternative A, the 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. 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 part 402). The National Environmental Policy Act (NEPA) mandates that Federal agencies conduct NEPA analysis "in cooperation with State and local governments" (42 U.S.C. §§ 4331(a), 4332(2)). 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); State, local, or tribal governments may request, or be invited, to be a cooperating agency as well.

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, USDI Bureau of Land Management 1994); the Interior Columbia Basin Assessment (Quigley et al. 1996); the Southern Forest Resource Assessment (Wear et al. 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. They have 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.

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.

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 (Proposed Action) Effects

Alternative A contains requirements for collaboration with Tribes, States, local governments, other Federal agencies, and private landowners similar to the existing regulations (Alternative B). 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 current procedures (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.

Alternative B (No Action) 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 current rule procedures (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 176 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 which are at the same scale as a new planning rule.

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), which is currently enjoined by court order but whose final legal determination is still pending in the Tenth Circuit Court of Appeals; and
- The soon to be proposed Colorado Roadless Rule (http://roadless).

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, and the Colorado State rulemaking petition and preliminary alternatives, and introduced legislation (H.R. 1975, H.R. 2516, and S.1478) (See Appendix I).

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.
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 proposed rule and 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, like 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, 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 the public lands managed by the Bureau of Land Management in 11 states (US Department of Energy; US Department of Interior, BLM 2008). Others, such as the Sierra Forest Plan Amendment, commonly called the Sierra Nevada Framework, applies 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 proposed rule and alternatives as they do not change the outcomes of the rule.

Additionally, there have been regional assessments—such as the Southern Appalachian Assessment (Wear et al. 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 to reduce consistency in plan content across the NFS for a 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 inherent differences among plans. The inconsistency created by the adoption of a new planning rule would require recognition by the Agency and the public that plans might 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, in the plan amendment or plan revision process. Accordingly, the proposed planning rule and 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).

The proposed action and alternatives would set out procedural requirements for development, revision, and amendment of land management plans. 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 adhere 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

The proposed planning rule and alternative planning rules would set out procedural requirements whereby NFS land management plans are developed, revised, and amended. They would establish administrative procedures. These rules would not dictate the activities that would occur or not occur on administrative units of the NFS. Accordingly, the proposed planning rule and alternatives do not have energy requirements or energy conservation potential nor do they 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

Irreversible describes the loss of future options. 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. *Irretrievable* 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 themselves be an irreversible or irretrievable commitment of resources, nor would they 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. 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.