MANUAL FOR THE ENVIRONMENTAL REVIEW OF FOREST SERVICE LAND MANAGEMENT PLANS AND RELATED ACTIONS

USEPA

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TABLE OF CONTENTS

APPENDICES

LIST OF ILLUSTRATIONS

I. INTRODUCTION

The U.S. Forest Service has the responsibility for management of the lands and resources in the National Forest system, which totals 187 million acres in 44 states, Puerto Rico and the Virgin Islands. The 155 National Forests and 19 National Grasslands in the system contain some of the country's most valuable natural resources, including timber, minerals, grassland, wilderness, water, fish and wildlife. The Forest Service manages the lands and resources in accordance with the principles of sustained yield and multiple use, established as national policy in the Multiple-Use and Sustained Yield Act of 1960. Although demands for forest resources, including both commodity and non-commodity items, are steadily increasing, the capacity of the national forests to supply those resources without unacceptable environmental impacts is limited. Indeed, most of the major issues affecting management of the national forest system involve conflicts among competing uses of the lands and resources arising from supply/demand imbalances.

Planning and management of Forest Service lands are complex tasks due to the diversity of uses and resources involved and the competition among them. Some uses may be conflicting or incompatible, further complicating the Forest Service's management responsibilities. The array of possible uses for national forest lands also results in a wide range of potential environmental impacts which must be identified and evaluated as part of the forest land management planning process. Impacts may occur which affect nearly all areas of EPA's substantive responsibilities including water, air, noise, solid wastes and pesticides. Further, these plans may also involve EPA's procedural responsibilities for including public involvement throughout the NEPA review process, and satisfaction of other federal policies which affect the environment such as the Executive Orders for floodplain management and wetlands protection. In addition EPA has the responsibility to officially receive, review and comment on all draft EISs and provide comments to ensure that environmentally acceptable decisions are made.

I.A. Purpose and Organization of the Guidelines

With EPA's legal jurisdiction and special expertise, Section 102(2)(C) of NEPA obligates Federal agencies to obtain comments from EPA wherever an action related to air or water quality, noise abatement, solid waste management, generally applicable environmental radiation criteria and standards or other provisions of the authority of EPA are involved. Section 309 of the Clean Air Act Amendments of 1970 gives EPA the explicit legal mandate to comment in writing on the environmental impact of any matter relating to EPA's duties and responsibilities.

NEPA Authorities and Responsibilities

EPA has a requirement to be involved in several aspects of reviewing proposed Forest Service actions and assuring that NEPA responsibilities and requirements are satisfied. First, and generally, Section 102(2)(C) of NEPA requires that Federal agencies obtain comments from EPA whenever EPA's legal, jurisdiction or special expertise is affected. Second, EPA has specific responsibilities under 309 of the Clean Air Act to assure the implementation of NEPA:

(a) The Administrator shall review and comment in writing on the environmental impact of any matter relating to duties and responsibilities granted pursuant to this chapter or other provisions of the authority of the Administrator, contained in any (1) legislation proposed by any Federal department or agency, (2) newly authorized Federal projects for construction and any major Federal agency action (other than a project for construction) to which section 4332(2)(C) of this title applies, and (3) proposed regulations published by any department or agency of the Federal Government. Such written comment shall be made public at the conclusion of any such review.

(b) In the event the Administrator determines that any such legislation, action, or regulation is unsatisfactory from the standpoint of public health or welfare or environmental quality, he shall publish his determination and the matter shall be referred to the Council on Environmental Quality.

Section 309 directs the Administrator to make environmental referrals to the Council on Environmental Quality of matters which are "unsatisfactory from the standpoint of public health or welfare or environmental quality." To implement these responsibilities, the EPA manual Review of Federal Actions Impacting the Environment (hereafter referred to as the "309 Review Manual") has established detailed policies, responsibilities and administrative procedures for the Agency's review of Federal actions impacting the environment.

The 309 Review Manual provides that, where an environmental impact statement (EIS) has been submitted to EPA for comment, EPA's comments on the EIS shall also constitute its comments for purposes of the Section review. Furthermore, it is EPA policy to use the Section 309 review process in conjunction with EPA's other authorities to: (a) provide technical assistance to Federal, State, regional, and local governmental entities; (b) assist the environmentally related activities of EPA and other Federal, State, regional, and local entities; and (c) assist Federal agencies in meeting the objectives of the National Environmental Policy Act.

Other Responsibilities

Further, under several agreements with the Department of Agriculture and the U.S. Forest Service, EPA has both responsibility and authority to cooperate and provide specific assistance to the Forest Service in carrying out several major functions. The EPA/DOA agreement, signed in 1979 by Secretary of Agriculture Bergland and EPA Administrator Costle (see Appendix B), provides for a continuing working relationship between the two agencies to:

1. Cooperate in establishing processes for coordinating activities and communications.

2. Encourage, guide and coordinate individual agencies of the DOA and regional offices and research laboratories of EPA in developing working arrangements for joint program efforts.

3. Encourage and direct programs and activities toward balanced improvement and maintenance of the quality of the Nation's natural resources and environment.

4. Encourage dialogue and exchange of information and program development including cooperative undertakings.

On February 14, 1979, EPA Deputy Administrator Blum and Forest Service Chief McGuire signed an agreement committing both agencies to cooperate in achieving water quality protection. As part of the FS-EPA Water Quality Agreement, EPA is participating in a multi-year review of the implementation of the newly revised Land Management Planning Regulations. This review will include both the implementation of the new Forest Land management planning process and the coordination of this process with related EPA procedures. As a result of this effort, recommendations will be made to the FS to improve the land management planning process, so that it will better protect the environment. Similarly, recommendations will be made to EPA to improve EPA coordination with the land management plan, its review and implementation. The user should be alert for new technical guidance, policies or procedures for EPA involvement in the planning process that may be forthcoming from EPA/FS coordination.

Further, as a result of 1978 amendments to the Clean Water Act, (CWA), the so-called "Culver Amendments" to the CWA, and subsequent funding in 1979, the Rural Clean Water Program has developed. As part of these later two agreements, the Forest Service is actively promoting the implementation of silvicultural Best Management Practices (BMP).

Further, under provisions of amendments to NEPA in 19 , EPA and its Office of Environmental Review was designated as the agency for officially filing EISs.

The 309 review conducted by EPA includes two specific subcomponents. The first is a review of the quality of the environmental assessment included in the draft EIS filed with EPA. Second, a review and evaluation is prepared which indicates the relative severity of the likely impact upon the environment. (See Table 2 in the following chapter).

Because the 309 Review Manual does not provide guidance for applying the Section 309 review process to specific types of projects, the Office of Environmental Review, in conjunction with the EPA program and regional offices, has prepared a series of detailed review guidelines for several major project categories. As one of the documents in that series, this manual provides detailed guidance for applying the EPA NEPA review process to Forest Service land management plans and related actions. Chapter II of this manual further expands upon the guidance for implementing the EPA policy described above. Chapter III provides a synthesis of the possible impacts associated with a variety of forms of national forest management and land use. Information on the analysis and assessment of such impacts is also presented. A reference bibliography is provided to permit the reviewer to explore specific problem areas in greater depth.

This manual has been developed principally to aid in reviewing environmental impact statements prepared for forest land and resource management plans at the national forest level. However, other related land management planning activities of the Forest Service at the regional and national levels are closely related to forest planning, differing mainly in geographic scope, specificity and amount of detail. Therefore, the guidelines can also serve as a means to understand and evaluate the environmental and other issues associated with the development and implementation of such plans.

How this manual can be used depends on several factors. Important among these is the level of familiarity of the user with the Forest Service planning and the environmental impacts that may result from plan implementation. Table 1 on the following page poses a series of questions representing steps in the environmental assessment process. It identifies specific sections in parentheses which provide guidance on each of the topics.

I.B. A Perspective on Forest Service Planning

The scope and intensity of land and resource planning by the Forest Service have been increasing. The increase has generally corresponded with and indeed been stimulated by, first, the rising demands for goods and services from the national forests and, more recently, continued demands coupled with increasing scarcity of resources and greater conflicts among resource uses. Administration policy directives to the Forest Service and legislative requirements and directions from Congress have been increasing. What has resulted is a national Forest System which is constantly undergoing adjustments in response to the dynamic nature of the forest land resource, the competing demands for various uses, and occasional erratic political pressures which reflect public needs and desires.

Early Planning

In the early years of this century national forest planning and use were directed primarily to local needs. Pressures on the land were slight and activities were decentralized without a great need for overall national coordination and policy direction. As the importance of national forest renewable resources to the national interest became more evident by the late 1930's, Forest Service policies focused on more intensive resource management.

Multiple Use - Sustained Yield Act

Although not formalized in legislation until 1960, the concepts of multiple use and sustained yield generally guided the Forest Service's management programs in the 1940's and 1950's. The Multiple Use - Sustained Yield Act of 1960, P.L. 86-517, set forth the basic policy for management of all national forest resources: that the national forests be managed for multiple use and sustained yield of products and services, with no one use predominating to the exclusion of other uses. Uses specifically mentioned in the Act are outdoor recreation, range, timber, watershed, and wildlife and fish. After passage of this act the Forest Service set up a process of "multiple use planning" under which separate multiple use plans were prepared for each National Forest Ranger District. At the National Forest level, resource development plans established the goals and objectives to be addressed in the Ranger District plans. This planning process continued until shortly after passage of the National Environmental Policy Act of 1969 (NEPA).

In the early 1970's Ranger District multiple-use plans were replaced by considerably more detailed land management "unit plans" which apply to geographic areas with similar resources and characteristics rather than to Ranger Districts. All unit plans were accompanied by and integrated with EISs which served as the analytic frame for comparing and evaluating the various components of land management unit plans. Also in the early 1970's the Forest Service undertook

Table 1: Organization and Use of Guidelines

Topic	Concerns		Pages
Forest Service Planning Process	How did the present process develop? (I.B.)		4
	What are the levels of planning? (I.C.)		7
	What is the nature of the process? (I.D.)		9
Forest Service Activities	What environmentally related actions are undertaken by the Forest Service? (I.E.)		11
Initiating the EIS Process	What are the first steps in the EIS/NEPA process? (II.A,B)		18-19
Review of Draft EIS	What is the purpose of the proposed action? (II.C.1.)		21
	What are the alternatives that should be considered? (II.C.2)		22
	What is the nature of the affected environment? (II.C.3)		25
	What is the nature of the environmental consequences? (II.C.4)		26
Identification of Impacts	What kinds of impacts are associated with Forest Service actions? Have they been identified in the EIS?	(III.A.1) (III.B.1) (III.C.1) (III.D.1) (III.E.1)	33 67 69 73 74
Quantification of Impacts	What information is required to properly evaluate the impacts?	(III.A.2) (III.B.2)	38 67
	What techniques are appropriate for quantifying the impacts?	(III.C.2) (III.D.2) (III.E.2)	70 73 75
	What mitigation measures are applicable to reducing the impacts?		
Assessment of Impacts	How should the reviewer judge the significance of impacts?	(III.A.3) (III.B.3) (III.C.3) (III.D.3) (III.E.3)	64 68 71 74 76
EIS rating	What standards, criteria, and regulations need to be considered in relation to Forest Service activities? (II.D)		28
	On what should the EIS rating be based?		

nationwide inventories and assessments of National Forest resources, including timber, rangelands and roadless areas. These and other studies formed the basis for a comprehensive plan, Environmental Program for the Future, which covered all Forest Service activities for the decade 1975-1984. The draft of the plan was issued in June 1974 just before Congress passed the Forest and Rangeland Renewable Resources Planning Act (RPA).

Resources Planning Act

The RPA was a response to the recognition by the Forest Service, Congress and others of the need for a long-term national program and policies for management of the National Forest lands and renewable resources, especially with regard to the supply and demand for such resources which reflected the national interest, as interpreted by Congress as well as the administration. For the first time, the specific management of the national Forest System was subject to congressional approval. The President and the Forest Service no longer have independent authority to manage the resources of the National Forest System.*

In terms of land management planning for units of the National Forest System, RPA had little effect on existing procedures but made land and resource management plans a legal requirement and called for a systematic, interdisciplinary approach in their development. The heart of the RPA is the requirement that the Secretary of Agriculture prepare a Renewable Resource Assessment and a Renewable Resource Program for the national forests and rangelands. The first Assessment and Program documents were prepared in 1975, and updated documents submitted to Congress in 1980. Thereafter, revisions are required every ten years for the Assessment and every five years for the Program. In addition, the RPA requires that a Report of Nation's Renewable Resources, including both private and non-private resources be made.

The Assessment is to include as a minimum:

(1) an analysis of present and anticipated uses, demand for, and supply of the renewable resources, with consideration of the international resource situation, and an emphasis of pertinent supply and demand and price relationship trends;

(2) an inventory, based on information developed by the Forest Service and other Federal agencies, of present and potential renewable resources, and an evaluation of opportunities for improving their yield of tangible and intangible goods and services, together with estimates of investment costs and direct and indirect returns to the Federal Government;

(3) a description of Forest Service programs and responsibilities in research, cooperative programs and management of the National Forest System, their interrelationships, and the relationship of these programs and responsibilities to public and private activities; and

*This revolutionary legislation could well be the subject of a historic drama. The Office of Management & Budget had recommended that President Nixon veto the RPA, primarily for its incursion into the Executive Authority of the President. However, the RPA along with OMB's recommendation reached the President's desk late in the morning of August 13, 1974. Given the flurry of activity associated with the President's resignation on noon of that day, he did not act on the RPA. Newly inaugurated President Ford, sensitive to the mood of Congress, disregarded OMB's recommendation, and signed RPA into law.

(4) a detailed study of personnel requirements as needed to satisfy existing and ongoing programs.

The Renewable Resource Program is to provide for the protection, management and development of the National Forest System in accordance with the Multiple Use - Sustained Yield Act and NEPA and in relation to the findings of the Assessment. Contents include but are not limited to:

(1) an inventory of specific needs and opportunities for both public and private program investments. The inventory shall differentiate between activities which are of a capital nature and those which are of an operational nature;

(2) specific identification of Program outputs, results anticipated and benefits associated with investments in such a manner that the anticipated costs can be directly compared with the total related benefits and direct and indirect returns to the Federal Government;

(3) a discussion of priorities for accomplishment of inventoried Program opportunities, with specified costs, outputs, results and benefits; and

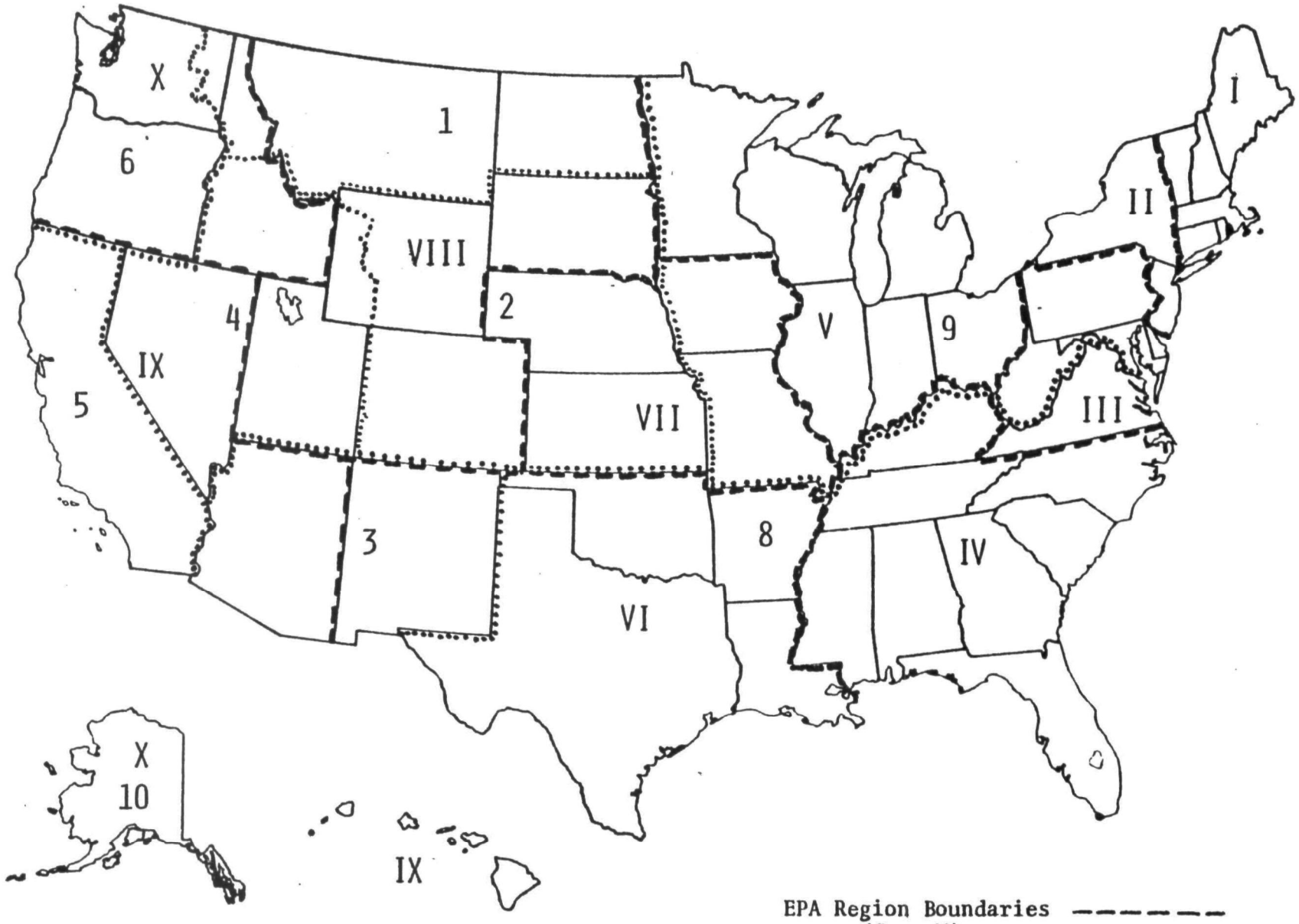
(4) a detailed study of personnel requirements as needed to satisfy existing and ongoing programs.

National Forest Management Act

The National Forest Management Act of 1976 amended RPA to provide more definitive statutory direction for land and resource management planning and to strengthen public participation in the planning process. The Act also expanded the scope of issues to be addressed in the Renewable Resource Assessment and Renewable Resource Program. Section 6 which deals with National Forest System Resource Planning includes directives for comprehensive multiple-use resource planning, guidelines for timber harvesting and sales, provisions for public participation in forest planning and requirements for preparation of regulations that set out the process for developing and revising land management plans. Land management plans for all units of the National Forest system are to be completed by 1985 and revised at least every fifteen years. The final planning regulations and procedures in response to the National Forest Management Act were published in the September 17, 1979 Federal Register.

I.C. Forest Service Planning Levels and Relationships

National forest planning is carried out at three levels: national, regional (9 USFS regions) and designated forest planning area. See Figure 1. The planning processes set up by the Resources Planning Act as amended require close coordination among all three planning levels. The Chief of the Forest Service is responsible for developing the Renewable Resource Assessment and Renewable Resource Program required by RPA. These documents provide service-wide goals, objectives and policies for national forest management. These documents are also closely related to specific forest units. They are based on resource information aggregated and summarized by the regions from individual national forests and in turn provide goal targets for these forests. The national goals



1. Northern
2. Rocky Mountain
3. Southwestern
4. Intermountain
5. California
6. Pacific Northwest
8. Southern
9. Eastern
10. Alaska

Figure 1: Forest Service and EPA Regions

and objectives, expressed as a range of outputs, are then allocated to the regions on the basis of supply capabilities and market conditions. The RPA Assessment was updated in 1979 and will be updated every ten years. The Renewable Resource Program is to be updated every five years. The Program contains all of the elements required for an environmental impact statement under NEPA, and is filed as an EIS. Therefore, as part of the forest management and planning process, the requirements of NEPA must be satisfied (including scoping, circulation and review, etc.)

Each regional forester develops a regional plan which is responsive to the RPA Program directives. Regional objectives are assigned to designated forest planning areas based on supply capabilities, socioeconomic assessments, potential environmental effects, economic efficiency criteria, community stability objectives and resource management standards and guidelines. An environmental impact statement is prepared as part of the regional plan development or revision process. The planning regulations require that regional plans be reviewed for possible amendment in conjunction with the development of the national Assessment and Program or whenever implemented programs differ significantly from those called for in the plan. The regional forester is responsible for determining whether conditions or public demands have changed sufficiently to warrant plan revision. Regional planning provides a link between Service-wide planning and planning at the forest level, providing guidelines and direction for land management planning as well as summarizing local information for input to the national Renewable Resource Assessment and Program.

Forest land management plans are to be developed for all lands in the National Forest System. The plans may be prepared for individual national forests, or a combination or all of the forests within the jurisdiction of a forest supervisor. Forest plans are to be revised at least every ten years. As with regional plans, preparation of an environmental impact statement is an integral part of the forest planning process. National and regional goals, objectives and management directions guide the development of land management plans, as do the forest planning criteria set forth in the National Forest Management Act and planning regulations (33 CFR Part 210).

Certain activities of the Forest Service do not fall into the regional or forest planning/EIS process but rather are handled separately in project-specific or program EISs. For instance, major new recreational developments require detailed environmental impact analyses and preparation of a separate project EIS. Similarly, certain Forest Service operational programs affecting large areas, such as pesticide applications to control insect infestations, may be evaluated in generic EISs covering such programs. Such specific project EISs should, however, include by reference appropriate analyses prepared as part of generic and land management plan EISs. These analyses should be summarized and any tierings with existing environmental analyses indicated during the scoping process.

I.D. Land and Resource Management Planning Process

Because of the newness of the National Forest Management Act and implementing regulations, their impact on land management planning is not yet strongly evident.

However, the management plans and EISs developed first in certain "lead forests" will set precedents for future planning and environmental analysis. It is thus critically important for EPA to conduct thorough, substantive and constructive reviews of these early EISs.

Forest land and resource management planning and environmental assessment under NEPA are carried out as a single process. The process consists of a systematic set of interrelated actions that lead to management direction and fulfillment of NEPA requirements, including:

.. Identification and evaluation of public issues, management concerns and resource use and development opportunities

.. Preparation of planning criteria to guide the planning process and management direction

.. Direction offered by national and regional forest management directives and policies, such as RPA

.. Inventory data and information collection

.. Analysis of the management situation by local Forest Service staff.

.. Formulation of alternatives

.. Estimation of effects (including environmental) of implementing alternatives

.. Evaluation of effects of management alternatives

.. Selection of alternative (after publication of draft EIS)

.. Implementation of plan

.. Monitoring and evaluation

Inputs to the land management planning process include public input during the scoping process for the EIS as well as technical inputs from several sources. The targets set in the RPA Program for a wide range of commodity and non-commodity resources and values are allocated to Forest Service regions. Then, the proportions of goods and services assigned to national forests within the Region are developed in the regional planning process through negotiations with the individual forests, considering the cost and environmental impact trade-offs among all the forests in the Region. In this way the regional plan provides the basic direction for management planning at the national forest level.

Information and evaluations developed under the RARE II Program (Roadless Area Review and Evaluation) are also important planning inputs. In RARE II, roadless areas in the National Forest system have been rated according to their capability and value for various uses. The basic data and evaluations used in the Forest Service's Wilderness Area Rating System (WARS) and Development Opportunity Rating System (DORS) should be incorporated into the land management plan and the plan should be consistent with the results of such analyses.

EPA's involvement in the Forest Service planning process is important not only during review of environmental impact statements but also during development of plans and associated environmental assessments. The first opportunity is at

the beginning of the planning process when the responsible Forest Service official and interdisciplinary team are required to meet with representatives of Federal agencies and other persons to develop procedures for coordination of the planning effort. The forest planning regulations require additional conferences after public issues and management concerns have been identified, and prior to recommendation of the selected alternative.

I.E. Forest Service Land Management Activities and Issues

To help the user better understand what to expect to find in a FS land management plan for activities undertaken on national forests and the environmental impacts that may result, the principal areas of Forest Service concern are described briefly. Included below are discussions of timber, recreation, range, fish and wildlife, watershed and wilderness.

Timber. About 87 million acres of the national forests are classified as commercial forests. While Forest Service land comprises only 18 percent of the total commercial forest acreage in the U.S., it contains more than 50 percent of the country's timber inventory. Some segments of the public feel that the cutting levels established by the Forest Service should be increased mainly for economic reasons, while others contend that timber removal should be reduced to minimize adverse environmental, recreational and other impacts. In spite of arguments both ways, the Forest Service's management of the timber resources is directed primarily toward even-flow sustained yield of lumber and forest products. This policy ensures a continuous supply of high quality timber for the future. Because of the long growth cycles of forests, increases in allowable cut above the rate of growth for short-term gain effectively reduce future yields of forest products. However, with amendment to Section 16 of the NFMA and an administration directive to the FS to consider temporary departures from even flow, problems of such proposed increased cuts must be reviewed carefully.

Timber management on the national forests involves the questions of not only how much to cut but also how, when, and where to cut. Moreover, silvicultural practices for regeneration, thinning and disease and pest control all affect the decisions made with regard to timber harvesting. Timber cutting often conflicts in some way with other perceived uses of the national forests but such conflicts can and should be minimized during development of land management plans. The diverse resource base necessitates compromise in its use and management.

Of all the uses of national forests, silvicultural activities generally have the greatest potential to adversely impact the environment, both locally and over large areas. The principal area of concern is water quality. Solid waste, noise, air, pesticide and socio-economic impacts are also likely to occur. Water pollution from forestry activities comes mainly from nonpoint sources; a variety of management practices, both structural and nonstructural, are thus required to prevent or reduce water quality degradation. EPA prescribed Best Management Practices should be considered carefully in such situations.

Site disturbances caused by logging, skidding, logging road construction, heavy equipment operation, burning, and other silvicultural activities can all lead to erosion and sediment pollution. Topography, precipitation, soil conditions and

other factors have a strong influence on sediment generation. Under conditions of steep slopes, unstable and erodible soils, and heavy rainfall, the risk of sediment pollution as measured by stream bed sedimentation is high for any site-disturbing activities. Such factors need to be carefully evaluated for sites that will be affected by road building, lumbering, and other silvicultural practices. Of all such factors, road building generally has the greatest impact.

Many of the practices required for timber management on the national forests involve only short-term disruption followed by long periods when no management is undertaken and pollutional output is low. The scheduling of timber-related activities is also important in the short run, as the potential for water pollution may vary seasonally with differences in precipitation, runoff, and ground conditions. A complete evaluation of impacts should include consideration of the timing of activities in the short term and over the planning period. Special attention should be given to departures from sustained yield/even flow timber management under the exemption provisions of Section 16 of the NFMA and the June 12, 1979 administration directive emphasizing the utilization of the exemption provision.

Management of residues from timber harvesting, including slash, brush, tree tops, and other debris, is a major problem in some national forests. Forest residues are not solid wastes in the usual sense of residential-type refuse, but some of the management needs are similar. Volumes can be large and proper disposal can be important for aesthetic and water quality reasons. Often an overriding concern in residue management is reducing heavy accumulations of woody debris. Wildfires can be particularly dangerous, difficult to control and damaging if they start or spread in areas where sizable volumes of residue exist from thinning or logging. Under controlled conditions, however, fire can be an effective management tool for slash disposal and reducing the risk of uncontrollable forest fires. If burning in an area is severe enough, considerable quantities of litter and soil organic matter may be consumed. Erosion may then become a problem in these areas. Soil disturbances caused by mechanical treatment or piling of slash may also induce erosion and sedimentation, creating an oxygen demand and increasing the possibility of channel blockage and erosion. Whenever timber harvesting or thinning is proposed, slash will be generated and plans must be formulated for management and disposal of the material in an environmentally acceptable manner.

Pesticides used in timber management include herbicides, insecticides, fungicides and rodenticides. Herbicides are by far the most widely used in terms of both quantity and area treated. They are used mainly for suppression of unwanted vegetation in the preparation of brush fields and cutover areas for reforestation and for the control of undergrowth and competing species in young stands. Herbicides and insecticides are applied by aerial and ground methods whereas aircraft are not generally used for rodenticides and fungicides. With aerial application, introduction of pesticides to water bodies and drift to nontarget areas are possible. Special precautions are necessary in planning and carrying out aerial spraying to minimize such occurrences. On-the-ground methods, including hand injection or spraying, use of rodenticides in bait, seed treatment and others, pose little risk for water quality degradation or environmental damage due to the small quantities of pesticides used and the high level of control

possible during application. A few pesticide chemicals tend to bio-accumulate in the tissues of animals at higher food chain levels, in addition to potential problems of toxicity and persistence in the environment. Separate EISs are prepared for proposed major pesticide programs of the Forest Service, although smaller scale usage of pesticides should be addressed in the land management plan and EIS.

Recreation. The national forests are an important, valuable and popular recreation resource for millions of people. The Forest Service provides a variety of recreational facilities, including 7,000 camp and picnic grounds for accommodation of half a million people, 1,100 boating and swimming sites, over 1,000 observation and interpretation sites, and several hundred ski areas. Nevertheless, activities such as sightseeing, hiking, mountain climbing, hunting and fishing that require limited or no special facilities account for about 60 percent of the visitor days spent in the national forests. Usage of the national forests currently exceeds 200 million visitor days each year.

Water is a focal point for many outdoor recreational activities. The national forests contain 84,000 miles of fishing rivers and streams and 2.5 million acres of lake surface in thousands of natural lakes and reservoir impoundments. To provide access to the forests, there are more than 200,000 miles of forest highways and development roads and 100,000 miles of trails.

Rapid growth in recreation use has created additional pressure on national forest resources. Much of the problem centers around distribution of visitation rather than total numbers of visitors, especially in regard to wilderness lands. Some areas are overutilized (often those located near large metropolitan areas) while others in more remote areas have relatively few visitors.

Not all of the recreational facilities on the national forests are developed and operated by the Forest Service. For example, most of ski areas, organization camps, resorts, commercial recreation facilities and other establishments on national forest lands are privately operated under special use permits issued by the Forest Service. The Forest Service attempts to retain sufficient administrative control over facility design, construction and operation so that environmental and other values can be protected. And in the case of major developments, such as new ski areas, separate EISs are required to ensure a comprehensive evaluation of potential environmental impacts and measures for mitigation of impacts.

Much of the recreational activity on national forests causes few if any environmental problems. The potential does exist, however, for adverse impacts in the areas of water, air, noise and solid wastes. Soil compaction and destruction of gound cover are common problems at heavily used recreation sites such as picnic and camp grounds and hiking trails and may cause soil erosion and sedimentation of nearby streams. These possible impacts can be minimized during the planning of new recreation facilities by avoiding areas with steep slopes and poor soils. For existing facilities where erosion has occurred, remedial measures including revegetation and installation of drainage and slope stabilization structures may be necessary. In addition, temporary closure or reduction of use of eroding areas may need to be considered. Hiking trails and ski areas, because they frequently traverse steep slopes and potentially unstable soils, are particularly susceptible to erosion. It is essential that programs for regular maintenance

and erosion control in such areas are fully addressed in the management plan and EIS.

Recreational use of national forests is accompanied by generation of solid waste which must be properly managed to avoid undesirable environmental impacts. The Forest Service has little direct control over littering and solid waste disposal outside of established picnic, camping, and other recreational areas where refuse containers can be conveniently maintained and emptied regularly. Provisions should be made for solid waste storage, collection, and disposal in all areas of concentrated recreational use.

Off-road vehicle (ORV) usage poses the threat of severe erosion, vegetation damage, and other environmental degradation unless carefully regulated and monitored. Snowmobiles, motorcycles, and four-wheel drive vehicles are the major types; the total number in use is estimated to exceed 10 million. Executive Order 11989 issued in 1977 amends an earlier order (11644) and directs federal agencies to control the use of off-road vehicles where they have caused or are likely to cause environmental damage. Controls may include complete prohibition of ORV use in sensitive environments, restriction of use to designated trails and restrictions on the time or season of operation. Besides the potential for physical damage to the environment, off-road vehicles are a source of noise pollution. Noise probably represents the greatest area of conflict between off-road recreational vehicle users and other recreationists in the national forests. Reduction of noise pollution from recreational vehicles can be accomplished in two ways: (1) limiting noise levels of individual vehicles and (2) segregating off-road vehicle use geographically from other recreational land uses to minimize interactions between the potentially conflicting activities. Motorized vehicles are barred from using lands designated as part of the National Wilderness Preservation System, thus avoiding noise impacts in those areas.

Range. Certain areas of the national forests and national grasslands in the western United States are open to grazing by domestic livestock. Concern has been expressed that the low costs of grazing on public lands, consistently about one-third of the average commercial costs, have led to overgrazing and environmental deterioration (CEQ, 1978). Grazing can lead to soil compaction, degradation of herbaceous vegetation, soil erosion, stream sedimentation, and fecal pollution. There has not been a great deal of research on the nature and extent of grazing impacts on land and water resources. It is clear, however, that regular inspection and monitoring of grazing lands for signs of deterioration are important in preventing adverse environmental effects.

Demand for range grazing has grown in recent years and is expected to continue increasing in the future. Greater use of the national forest lands for grazing is likely; therefore, management plans need to address the environmental consequences that such increased use would have.

Fish and Wildlife. Management programs for fish and wildlife resources on the national forests often involve the restoration and enhancement of habitat for terrestrial and aquatic species. Whereas fish and wildlife management activities do not in general adversely impact the environment, other national forest land uses and land management practices are very much interrelated with and

can affect fish and wildlife resources. What is best for timber production, for instance, may adversely impact fisheries or wildlife. In managing for multiple uses, trade-offs and compromises among resources are frequently necessary, and the broader implications of all activities should be recognized and balanced in the land management planning process. Planned actions having potential effects on fish and wildlife must be coordinated with the Fish and Wildlife Service as required in the Fish and Wildlife Coordination Act.

Watershed. National forest system lands produce more than one-quarter of the total amount of water that flows from watersheds throughout the country. Water from forested watersheds is usually of high quality but can be degraded by both point and nonpoint pollution from other forest management activities as well as from sources outside of the national forests. Maintenance of water quality is an integral part of all Forest Service land management planning. The Environmental Protection Agency is also involved through administration of federal water pollution control programs. Management and use of the national forests must be carried out in a manner consistent with national water quality goals and objectives. Management actions in the national forests should represent Best Management Practices and serve as a model for similar actions on private lands under the Rural Clean Water Program, authorized by Section 208 of P.L. 92-500 as amended. Often EPA's responsibilities for water quality in both ground and surface waters are affected by actions taken in managing the national forests.

Wilderness. The National Wilderness Preservation System, established with passage of the Wilderness Act of 1964, presently includes 16.5 million acres of public lands. The potential exists for considerable expansion of the system in the future. The Forest Service has developed an inventory of national forest lands for consideration for wilderness. The inventory, known as RARE II (Roadless Area Review and Evaluation) follows an earlier review (RARE I) and determines which areas to propose for wilderness and nonwilderness uses and which need further study before determinations can be made.

Visitation to wilderness areas has grown rapidly in recent years. Backpacking is the most popular of wilderness activities and, in some wilderness areas receiving heavy use, has contributed to soil erosion along trails and other adverse effects. As more and more people use wilderness areas and the reduction of de facto wilderness areas continue, the potential for environmental degradation will increase. Means for identifying environmental problems and carrying out needed maintenance should be addressed in management planning for wilderness areas.

Other National Forest Resources. National forests contain large economically recoverable deposits of mineral and energy resources. A substantial portion of these resources lies in a mineral-rich belt extending from North Dakota to southern Arizona.

Mineral and energy resource extraction on national forest lands is an important enterprise. Major known resources on the national forests include phosphate, coal, oil shale, oil, gas, uranium, copper, nickel, lead and geothermal energy.

Most of these lands are open for mineral extraction and development. However, the Forest Service has no direct responsibility in the control, development, and leasing of mineral rights on the national forests. Such authority belongs to the Secretary of the Interior. Currently, hard rock mining on federally owned lands is goverened by provisions of the 1872 Mining Law, which allows miners to enter federal lands without a permit or license, claim any marketable body of ore, sell it without paying royalty and take title to the land itself where a valuable mineral deposit exists. The lack of clear authority to protect these lands creates the potential for environmental damage. Reforms of the mining law have been proposed by the Administration but not yet passed.

Although the Forest Service is not directly involved in mining issues, the environmental effects that may result are important in overall forest management. As mineral and energy deposits become increasingly scarce, pressure to accelerate mineral extraction from national forests is likely. The need for effective environmental controls will also increase.

Issues

The complexities inherent in the management of national forests for multiple uses are reflected in a number of difficult issues facing the Forest Service and other Federal agencies. Many of these issues concern EPA in view of its responsibilities for environmental protection. The Forest Service's 1980 RPA Program discusses fifteen significant overall issues, a few of which are highlighted in the following paragraphs.

Level of production of wood and wood products from National Forest System Lands. Timber harvesting must be carried out in conformance with statutory constraints, such as those specifying sustained yield and even flow management. Increases in timber harvesting, whether through more intensive management, accelerated cutting of old growth timber or departures from sustained yield, almost certainly necessitate trade-offs with respect to nontimber outputs and environmental impacts. In some cases creation of new access roads would be essential to permit increased harvesting levels. Socioeconomic and environmental effects of increased harvesting must be analyzed over both the short and long terms. There is strong public opposition in many areas to any deviations from the policy of nondeclining even-flow management.

Wood fiber as an energy source. In many parts of the country public pressure to have access to National Forest lands for firewood is increasing dramatically. This pressure is particularly strong in northern areas in New England, the Great Lakes and the Northwest. Administration of cordwood programs is difficult but proper supervision is necessary to ensure that concomitant silvicultural benefits are realized (through selectively culling dead and inferior trees, thinning etc.) and environmental impacts are minimized. Localized air pollution problems from wood burning could result from such Forest Service actions.

Herbicides and Pesticides in National Forest System Management. Possible long-term and secondary effects of pesticides are not well understood. Herbicides to control undesirable vegetation are often less costly than alternative non-chemical methods. Pesticides currently available may not be the best way to control insect infestations, but nonchemical methods often are not equally as effective. Options include continuing use of registered pesticides after careful environmental review, restricting use to only certain limited critical areas, discontinuance and research to develop nonchemical controls.

The user should try to keep informed of substantive forest management issues in his/her region and expect them to be addressed in the management plan and EIS.

II. LAND MANAGEMENT PLAN REVIEW

As described in the 309 Review Manual, the EPA EIS review process consists of pre-EIS activities, scoping, review of draft EISs, pre-final EIS liaison, review of final EISs and post-EIS follow-up. While it is recognized that unique situations within each region may dictate emphasis on one phase of the review process over another, all phases should be conducted to the fullest extent allowed by the region's resources.

The goal of the review process is to maximize the effectiveness of EPA involvement in management planning for national forest lands. Generally, this goal is accomplished when the EPA involvement: (1) reflects the total environmental responsibilities of EPA; (2) is part of a continuing working relationship with the Forest Service to improve national forest land use and management in accord with environmental quality objectives; (3) focuses sharply on environmentally unsatisfactory actions; (4) lends EPA support to management decisions having beneficial impacts on the environment; and (5) produces review responses which are expressed in constructive language, pointing out specific environmental problems and possible ways of avoiding or mitigating those problems.

II.A. Pre-EIS Activity

Pre-EIS activity is extremely important in preventing potential environmental problems from occurring. It is at the very early, pre-EIS stages of project development that environmental problems are most accessible to EPA-recommended mitigation measures. Similarly, the consideration of project alternatives is most open when done early in the planning process, before any single alternative is essentially selected and defended by project planners. The EIS review function is one of the few agency programs by which EPA practices prevention and proactive involvement rather than abatement of environmental problems and reactive involvement. To secure the greatest benefit from this program, effective Pre-EIS liaison is essential.

"Pre-EIS activity" includes pre-EIS coordination within EPA as well as coordination and information exchanges with Federal, State, and local agencies responsible for project planning or licensing. Pre-EIS activity within EPA involves the coordination of EIS review with other EPA actions which may affect or be affected by Forest Service land use and management decisions such as discharge permits (NPDES), review of 404 permits, non-point source management under Sections 208 and 303, Federal facilities pollution control under Section 313 and solid waste management at Federal facilities under Section 211 of the Solid Waste Disposal Act as amended. Additionally, EPA positions expressed previously as might be contained in reviews of earlier EISs (on pesticide programs, for example), congressional correspondence, or other agency statements, must be considered in developing a consistent EPA position. Further,

the priority environmental problems identified by the state's governor as part of the State-EPA Agreement should be considered in evaluating Forest Service land management plans.

External pre-EIS activity includes a wide range of activities outlined in the 309 Review Manual: (1) review of an applicant's environmental report or agency pre-draft EISs; (2) review of negative declarations; (3) participation at agency meetings describing the project; (4) substantive discussions with agency officials responsible for a proposed action, with emphasis on alternative mitigation measures; (5) provision of background materials for use in developing the EISs; (6) review of basin plans (Level B studies); (7) site visits. In order to fully realize such opportunities for pre-EIS liaison it is important that EIS Coordinators maintain frequent and regular contact with appropriate personnel at the Forest Service regional and national forest levels. EIS Coordinators should understand planning processes and associated outputs that might be useful in determining an early environmental assessment of developing land management plans.

In several technical areas -- for instance, water quality management and pesticides -- the responsibilities and interests of the EPA and the Forest Service intersect. The two agencies cooperate informally, and formally through Inter-agency Agreements, in technical studies dealing with the identification and control of nonpoint sources of water pollution from silvicultural activities, development and implementation of best management practices for silvicultural nonpoint sources and pesticide use and management. As a result of this cooperation there is general agreement between the Forest Service and EPA on the state of the art of management strategies for forest-related nonpoint source water pollution. Regional differences in the nature of forest management activities, physical and biological characteristics of forests, hydrology and other factors still necessitate site-specific evaluations of pollution potential and methods for minimizing adverse impacts. Nevertheless, the reviewer should be aware of the cooperative efforts being made for more effective environmental management of the national forests. Several of the publications described in the appended Reference Bibliography represent joint involvement of both the Forest Service and the EPA. Such documents provide the reviewer with technical information of value in guiding EPA's early participation in the forest planning process before an EIS is prepared.

II.B. Initiating the EIS/NEPA Process

The CEQ regulations for implementing the procedural provisions of NEPA (40 CFR 1500), published in the November 29, 1978 Federal Register, emphasize agency cooperation early in the NEPA process. Specifically, the EPA or any Federal agency having special expertise with any environmental issues posed by a project may request or be asked by the lead agency to be a "cooperating agency". The regulations require each cooperating agency to (a) participate in the NEPA process at the earliest possible time, (b) participate in the scoping process and (c) assist at the lead agency's request in developing environmental information and preparing environmental analyses relating to areas in which the cooperating agency has special expertise.

"Scoping", as defined in the CEQ regulations, is an early and open process for determining the scope of issues to be addressed and for identifying significant issues related to a proposed action. Scoping also involves identifying and eliminating from detailed study issues which are not significant or which have been covered by prior environmental review. The NEPA regulations encourage "tiering" of EISs to eliminate repetitive discussions of the same issues. Tiering refers to the coverage of general matters in broader environmental impact statements (such as Forest Service program or plan statements at the national or regional level) with subsequent narrower statements (such as statements for individual forest land management plans) incorporating by reference the general discussions and concentrating solely on the issues specific to the statement subsequently prepared. As part of the scoping process issues that have been adequately addressed in earlier, broader EISs should be eliminated from detailed study. They must, however, be summarized in the narrower EIS and appropriately referenced.

Other material may also be incorporated by reference into an EIS for a land management plan, with the purpose of reducing bulk and repetition without impeding review of the action. The material could include EISs prepared for a specific action affecting the national forest, such as a major new recreational facility or large scale pesticide applications, as well as other data or studies pertinent to evaluation of impacts of the land management plan. Attention should be given in the scoping process to material that will be incorporated into an EIS in this manner.

By participating in the scoping process, EPA can ensure that important concerns of water, air, solid waste, pesticides and other impact areas will be identified at an early stage and addressed in the EIS. This early involvement can contribute to resolving major environmental issues before the EIS is prepared and avoid or minimize problems later during EPA's review of the Draft EIS.

II.C. Review of the Draft EIS

EPA's purpose in review of the EIS is to ensure that proposed Federal actions are consistent with the attainment of national environmental goals and policies. The Administrator has specific responsibilities under Section 309 of the Clean Air Act to review proposed Federal actions and, to determine if any such action is unsatisfactory from the standpoint of public health, welfare, or environmental quality, to publish this determination and refer the matter to the Council on Environmental Quality.

In order to carry out these objectives, it is essential that the EPA reviewer assess the impacts related to air, water, noise, solid waste management and other environmental areas within EPA's jurisdiction. Review of the EIS must indicate whether the document adequately identifies, quantifies and evaluates the impacts associated with implementation of the proposed Plan and various

alternatives to it. EPA's EIS review responsibilities are substantive and not limited to critiquing the way in which the EIS is organized or written. However, the ability of the EIS to be understood and its availability by the public are concerns which can be addressed in the review by EPA. The EIS is to "provide full and fair discussion of significant environmental impacts and shall inform decision-makers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment. Statements shall be concise, clear, and to the point, and shall be supported by evidence that the agency has made the necessary environmental analyses." (40 CFR 1502.1). Similarly, EPA's comments on an EIS should be as specific as possible in identifying adequacy of the statement, merit of the alternatives and need for additional information.

The EIS format recommended in the new CEQ Regulations includes four major sections dealing with: (1) purpose and need for proposed action, (2) alternatives, (3) affected environment, and (4) environmental consequences. Guidance for reviewing each of these topics in Forest Service land management plan EISs follows.

II.C.1. Purpose and Need

The use and management of the national forests serve multiple purposes and needs, ranging from commodity items such as lumber and minerals to non-commodity items such as wilderness recreation experience. Although land and resource management generally implies some sort of action or activity, it may also involve the choice of doing little or nothing in an area which does not need improvement. For example, dispersed recreational use may not involve any specific action.

A primary purpose of land management plans is to provide for multiple use and sustained yield of the commodity and non-commodity values provided by the resources of the national forests in accordance with the Multiple-Use Sustained-Yield Act of 1960. The mix of uses that can be supported is unique for every national forest because of the diversity of physical features, location, climate, vegetation, population, economic and other factors. Thus, although the same planning and evaluation methodologies can be applied in a general way throughout the national forest system, the resulting plans are specific to the particular resources, conditions, needs and problems of individual planning units.

The EIS should provide a clear understanding of the needs, in terms of both commodity and non-commodity values that national forest land management is intended to meet. Although management decisions are generally governed by Forest Service policies specified in legislation and regulations, there is considerable flexibility at the local level to tailor specific management programs to meet the perceived needs within the constraints of the land's capability to meet those needs. The EIS should also distinguish among alternative management plans with respect to the types and degrees of benefits

they would provide. They should also indicate the trade-offs that would be made to satisfy various needs. When this has been done accurately and comparably for the available alternatives, the environmental impacts can be evaluated relative to other benefits and costs of alternative land management plans.

II.C.2. Alternatives Including the Proposed Action

As stated in the CEQ & FS Regulations, this section is the heart of the environmental impact statement. Environmental impacts of the proposal and alternatives should be presented in comparative form to define the issues and trade-offs and provide a clear basis for choice among the alternatives. Impacts should be described quantitatively if possible or qualitatively in such a manner as to illustrate the differences and related impacts, along with the relative magnitude of such impacts for the alternatives that are considered.

Alternatives generally involve how, where and when various management practices are implemented to meet multiple use and sustained yield objectives and at the same time satisfy environmental quality objectives. The many different resource values and land uses possible in managing Forest Service lands, present a wide range of alternative management approaches.

Management for diverse uses can be complicated, and intensive management for one purpose may reduce or preclude other land use opportunities in an area. For each alternative considered in an EIS, the contributions to a particular management objective and the implications for other land uses as well as the environmental effects must be presented to permit evaluation of their comparative impact. Also, the Forest Service's rules for national forest system land and resource management planning (36 CFR 219.5(h)) state that at least one alternative must be identified as environmentally preferable. The range of alternatives presented should include a reasonable range of practical alternatives which consider various combinations of possible subcomponents. These should include a wider range than "all development", "no development" and "a balanced approach."

EPA's review of alternatives should compare the plan components, such as the various options for timber or recreation management, as well as the integrated land management plans and associated impacts. Such plan components which are generally applicable to forest management activities and which should usually be considered in detail in the EIS comparison of alternatives include:

Timber Management Alternatives

- Method of harvesting, including clearcutting, shelterwood, seed-tree and selection methods. The cutting alternatives result in differing levels of site disturbance. Choices may also be made in the size of individual cutting areas.
- Method of logging. Options may include tractors, various cable systems, or aerial logging, each having different pollution potential. Requirements for logging road layout and density differ for the various logging systems.

- Timing. Weather, soil, and atmospheric conditions can strongly influence the potential for adverse environmental impacts from timber management activities. Seasonal or even daily variations in these factors may need to be considered in scheduling logging, road or other construction, burning and related activities in order to reduce pollution hazards.

- Location. Options normally exist for the choice of road locations and areas that will be harvested or subjected to other silvicultural treatments. Location decisions should be made with a view toward avoiding sites where disturbances would cause or contribute to erosion, water pollution, and other environmental problems. Alternative locations for some management practices, such as pesticide applications to control widespread insect infestations, are limited.

- Pesticides. Pesticide alternatives include the type of chemical, substitution of other controls, and the rates and methods of application employed. "Integrated pest management" (IPM) approaches involving combinations of biological, chemical, cultural and other methods are being developed for forestry and may reduce pesticide usage in certain situations.

- Residue management. Alternatives include do nothing, prescribed burning (several methods), mechanical treatment such as chipping, crushing or rearranging and leaving the debris, all with differing potentials for air and water pollution.

- Road Building. Road alternatives relate to density, location, design, construction and pollution control methods, maintenance and other factors which need to be evaluated in the context of site conditions, access requirements and other uses served by the forest lands. A further consideration is the secondary impact which will likely occur as access permits new uses.

- No action. The option of not carrying out timber management activities has to be evaluated, and may be the most desirable approach in areas having steep slopes, unstable soils, unique biota or other environmentally sensitive features. The EIS must clearly define "no action," whether it represents no change from present conditions or continuation of present management programs.

Recreational Alternatives

- Location. Location alternatives for recreational facilities, particularly those sustaining heavy, concentrated use, should be considered in the EIS. Soil conditions, topography, proximity to environmentally sensitive areas and other site characteristics all affect land suitability for recreational development and the potential for pollution. Recreational alternatives should be consistent with RARE II evaluations for particular areas.

- Scale of development. The potential for adverse environmental impacts increases with the scale of recreational development and use in an area. The size and capacity of proposed recreational developments should be based not only on projected needs in the region but also on the capability of land and water resources to support varying levels of use.

- Types of recreation. Recreational activities on national forest lands are many and varied, ranging from low density to high density uses with facility requirements ranging from essentially none to quite elaborate

developments for specialized uses such as skiing. Generally, though not always, lower density uses requiring few or no facilities cause less environmental impact than higher density uses.

- No Action. The consequences of foregoing development and management for particular recreational uses must be addressed along with the development alternatives in order to permit comparative evaluations of impacts.

Range Alternatives

- Management systems. A variety of grazing systems can be used to regulate intensity of use, involving seasonal grazing, rest periods and rotation arrangements. Structural measures can also be used to mitigate adverse grazing impacts. These include fencing and providing water supplies away from streams and other measures. Erosion and other impacts are usually associated with overgrazing in an area, as well as animal waste runoff.
- Soil treatment. Furrowing, trenching, pitting, waterspreading and retention basins are alternatives for increasing infiltration capacity and reducing erosion and sedimentation from range lands. The need for and applicability of such methods depend on the specific characteristics of individual areas.
- Vegetation management alternatives. These may include seeding to establish or re-establish desirable herbaceous species, fertilization, burning and other practices.
- No action. Properly managed grazing can actually result in beneficial effects in terms of stimulating denser, more vigorous vegetative cover and minimizing soil losses. The consequences of closing areas to grazing as well as foregoing any management activities should be evaluated.

Fish and Wildlife Alternatives

- Selected species. Management is generally tailored to the habitat requirements of certain species of fish or wildlife. Habitat modifications are likely to benefit other wildlife as well, but may also be detrimental to species having different needs.
- Structural measures. Management of the aquatic habitat may involve construction of small impoundments, flow retarding structures, devices for water level regulation and other facilities. Hydrologic and other modifications brought about by impoundments can impact on surface water quality.
- Mitigation. Protection is often necessary for some species which may suffer adverse impacts as a result of forest management actions. Many actions can be recommended or required in the forest management program which could benefit fish and wildlife. Such mitigation measures are often developed through negotiation and consultation with the Fish and Wildlife Service through the Fish & Wildlife Coordination Act procedures. The results of such consultation should be included in the plan and EIS.
- No action. Although most fish and wildlife management activities will produce beneficial environmental effects, the alternative of no action must also be considered.

Watershed Management Alternatives

Watershed management is an integral part of other Forest Service management activities. The quantity and quality of water supplied as surface runoff from the national forests are affected by the ways in which silvicultural and other management practices are carried out. Whereas most management activities and land uses may affect water quality, timber harvesting, particularly clear-cutting, may also result in increases in the rate and total volume of runoff from a watershed. Although such effects decrease with time as new vegetation becomes established, consideration must be given to the possible impacts on stream flows and flood potential.

Special or Critical Areas or Resource Management Alternatives

Management alternatives for wilderness, wetlands, floodplains, endangered or threatened species habitat and other critical areas should be oriented toward protection and conservation rather than development and intensive use. Such areas are by their nature especially vulnerable to disturbances from human activity. The supply of de facto wilderness as well as other critical areas nationwide is shrinking, and management alternatives of limited scope and impact deserve consideration in such areas. Of primary importance is the monitoring of use levels and environmental conditions to prevent damage to vegetation, erosion, water pollution and other deterioration.

Socio-Economic Alternatives

In some areas of the country, most notably the Pacific Northwest and Rocky Mountain states, the national forests have important and sometimes predominant influence on local and regional economies. Alternatives for timber harvesting, recreation and other programs can have economic consequences which vary according to the emphasis given to the programs. Occasions may arise where, for example, short-term departures from sustained yield effect significant socio-economic benefits to depressed wood processing industries in an area. It is important that the socio-economic implications, both favorable and adverse, of management alternatives are pointed out in the EIS. At the same time, the EIS should identify any environmental trade-offs associated with departures from sustained yield of both products and services.

II.C.3. Affected Environment

This section of the EIS should contain descriptions of the environment of the area to be affected by the components of the plan alternatives under consideration. The data and analyses should not include extraneous material that is not relevant to important impacts and issues, and should include all of the concerns identified in the scope of the EIS. The characteristics of land and water resources included in the area strongly influence the nature and magnitude of impacts associated with forest land management and use alternatives. The physical and other features need to be described sufficiently to understand the similarities and differences in environmental conditions from one area to another within the planning unit. Also, descriptions should be thorough enough to permit identification and evaluation of sensitive areas which are susceptible to the effects of pollution or hazardous areas which are apt to

contribute to the generation of pollutants if disturbed. A number of critical areas, including wetlands, floodplains, historic sites, wilderness, wild and scenic rivers and rare and endangered species, are subject to special protection procedures set forth in national policy, legislation and regulations. The EIS must address such critical areas and demonstrate that land management planning actions will meet the requirements of those special protection procedures. Information on the affected environment basic to impact assessment includes:

- Socio-economic considerations
- Topography, including slope lengths, steepness, aspect and elevation
- Soil properties, such as permeability, texture and susceptibility to erosion
- Precipitation amounts, intensity and seasonal variation
- Vegetative cover
- Stream flow and variations
- Nature of stream beds and banks
- Existing water quality in relation to applicable water quality standards, stream classifications and uses
- Point and nonpoint sources of pollution
- Stream biota including rare or endangered species and sensitive species
- Wetlands
- Floodplains
- Unique/fragile resources (endangered species, historic sites, scenic and wild rivers etc.)

Information describing the affected environment has two basic uses. First, it may be necessary in determining the likelihood and quantifying the impacts in a given area as a result of certain management activities. For example, clear-cutting timber in a generally flat and level area is not likely to induce significant erosion or soil movement problems, whereas the same activity in steep, mountainous terrain presents a much higher risk of erosion and sedimentation. Second, information describing the affected environment is needed to characterize the relative significance of environmental impacts generated by forest management activities. For instance, introduction of sediment or other pollutants to a stream supporting anadromous fisheries, or species that are rare or endangered may be of more critical concern than the comparable water quality effects in a watercourse not having these special characteristics. Also, a good understanding of baseline environmental conditions is essential for monitoring changes and impacts resulting from ongoing management activities.

II.C.4. Environmental Consequences

The environmental consequences section of the EIS should form the scientific and analytic basis to compare alternatives including the proposed action. In this section, discussions of the elements required by NEPA should be presented. These include the sections dealing with environmental impacts, adverse environmental effects which cannot be avoided, relationship between short-term uses of man's environment and maintenance and enhancement of long-term productivity and irreversible or irretrievable commitments of resources.

Both direct and indirect environmental impacts must be considered, as well as possible conflicts between the proposed action and objectives of land use plans, policies and controls for the area concerned, energy and resource requirements and conservation potential and means to mitigate adverse environmental effects.

Review of probable impacts should include evaluations that all potentially significant impacts have been identified, adequately quantified (within the limits of state-of-the-art techniques and commensurate with the expected severity of the impact), and measured against applicable standards, criteria and regulations. The identification of potential impacts should be based on adequate descriptions of proposed activities, characteristics of the affected environment and their relationships. The reviewer should particularly evaluate whether sufficient information is presented to identify all potentially affected sensitive areas and areas highly susceptible to erosion or other problems.

Many of the impacts of Forest Service activities, especially nonpoint source air and water pollution, are difficult or impossible to predict quantitatively. However, this does not mean that certain impacts cannot be evaluated. Adverse effects from a given activity may differ in severity from one area to another depending on the presence of critical fish and wildlife habitats, for example, or differing vulnerabilities of the areas to erosion induced by site disturbances. Again, site-specific information in conducting impact evaluations, either quantitative or qualitative, is important.

Mitigation measures for both the prevention and reduction of adverse impacts are essential for minimizing the impacts of Forest Service management activities. Most mitigating techniques involve management practices for dealing with nonpoint sources of water pollution. Careful planning of how, when and where various activities are carried out is the key to effective mitigation. The discussion of environmental consequences must also cover the mitigating measures that are necessary to reduce the probable impacts. Mitigation measures are appropriate wherever site conditions indicate a high probability of erosion or other impacts and where special fish, wildlife or other resource values could be adversely affected. Also, mitigation measures should be representative of best management practices to conform with areawide water quality goals set forth in state or areawide water quality management plans.

The information in Chapter III of these guidelines identifies the range of water, solid waste, air, noise and pesticide impacts that may arise from various Forest Service land management activities. The emphasis is on characterization of the environmental conditions that are likely to contribute to pollution problems as well as alternative approaches that can be taken in the location, timing and nature of activities to prevent or mitigate adverse impacts.

II.D. Project Rating

The basis for the EPA comments on the environmental impact of land management plans is quite broad. As stated in the Clean Air Act, Section 309(a), EPA comments on"...any matter relating to duties and responsibilities granted pursuant to this Act or other provisions of the authority of the Administrator..." NEPA, section 102(2) (C) states"...the responsible Federal official shall consult with and obtain the comments of any federal agency which has jurisdiction by law or special expertise with respect to the environmental impact involved."

The above mandates have been interpreted to mean that the EPA comments should be related to the impact of projects on water quality, air quality, solid waste management, noise, radiation control and pesticide and other toxic substances use and control. Water quality concerns include protection of beneficial water uses, floodplains and wetlands, aquatic life and habitat and water-related wildlife. Comments related to land use, terrestrial wildlife, aesthetics, recreation and other areas must be related to areas of expertise. In addition with responsibility for being the official receiver of filed EISs, EPA has certain specific responsibilities concerning EIS filing procedures. For example, EPA must be assured that an EIS document is in fact available to the public before it can officially begin the 90 day review period for draft EISs, or the 45 day review period for final EISs.

As detailed in the 309 Review Manual, the EPA rating scheme is different for draft EISs, final EISs and pre-Clean Air Act Amendments EISs. At the draft stage comments shall be designated by an environmental impact rating of LO (Lack of Objections), ER (Environmental Reservations) or EU (Environmentally Unsatisfactory), Category 2 (Insufficient Information), or Category 3 (Inadequate). See Table 2. Draft EIS comments which the principal reviewer is contemplating rating EU or 3 must be cleared by OER prior to release. If a draft EIS is assigned a Category 3, normally no rating will be made on the environmental impact of the proposed project or action since a basis does not generally exist on which to make such a determination. When there is a basis for assessing the environmental impact of a proposed action, such as independent documents or on-site surveys, such a rating may be established at the discretion of the principal reviewer after consultation with OER.

EPA's comments on the draft EIS should be constructive and aid the environmental decision-making process. Comments should address, as appropriate, environmental impacts and alternatives that need further discussion and other ways to improve the EIS.

Also, reasons for assigning a particular rating should be stated with reference to any laws, regulations, or policies which support EPA's judgment. The specific basis for EPA assessment of environmental impacts and rating of the EIS consists of the standards, criteria, EPA policy decisions and consistency requirements with other EPA program responsibilities as shown in Table 3a.

At the final stage, no alpha-numeric designations are made since only the project impact is considered and not the completeness of the EIS. The project impact rating assignments for the final EIS consis of: Lack of Objection, Environmental Reservations and Environmentally Unsatisfactory. A rating assignment of Unresponsive Final Impact Statement can be made if the final EIS has not responded adequately to comments made by EPA on the draft EIS. Such comments may also be offered if new environmental concerns have been brought to

Table 2: Categories for Rating EISs

Category 1 (Adequate). The draft EIS adequately sets forth the environmental impact of the proposed action as well as alternatives reasonably available to the project or action.

Category 2 (Insufficient Information). EPA believes that the draft EIS does not contain sufficient information to assess fully the environmental impact of the proposed action. However, from the information submitted, EPA is able to make a preliminary determination of the impact on the environment. EPA has requested that the originator provide the information that was not included in the draft EIS.

Category 3 (Inadequate). EPA believes that the draft EIS does not adequately assess the environmental impact of the proposed project or action, or that the statement inadequately analyzes reasonably available alternatives. EPA has requested more information and analysis concerning the potential environmental hazards and has asked that substantial revision be made to the draft EIS.

Evaluation of Environmental Impact of Proposed Actions

LO (Lack of Objections). EPA has no objections to the proposed action as described in the draft EIS or suggests only minor changes in the proposed action.

ER (Environmental Reservations). EPA has reservations concerning the environmental effects of certain aspects of the proposed action as described in the draft EIS. EPA believes that further study of suggested alternatives or modifications is required and has asked the originating Federal agency to reassess these aspects.

EU (Environmentally Unsatisfactory). EPA believes that the proposed action is unsatisfactory because of its potentially harmful effect on the environment. Furthermore, EPA believes that the potential safeguards which might be utilized may not adequately protect the environment from hazards arising from this action. EPA recommends that alternatives to the action be analyzed further (including the possibility of no action at all).

EPA's attention since the review of the draft EIS and the originating agency does not adequately evaluate these factors in the final EIS.

Criteria for assigning the Environmental Reservations, Environmentally Unsatisfactory, or Category 3 rating are given in Table 3b. The reviewer should note that these criteria are intended to be used as guidelines rather than strict rules. The decision regarding the impact of each land management plan must incorporate all the mitigating factors affecting the plan. The sensitivity of the environment to the changes imposed by implementation of the plan as well as the effectiveness of mitigation measures must be taken into account.

TABLE 3A: EPA Standards, Criteria and Regulations Related to Forest Service Land Management Plans

Standards

--Latest version of primary drinking water standards prepared by EPA pursuant to the Safe Drinking Water Act (PL 93-523)
--Water Quality: State adopted water quality standards consisting of water quality criteria and plans for the enforcement and implementation as referenced in 40 CFR Part 120.
--Air Quality: National primary and secondary ambient air quality standards as specified in 40 CFR Part 50

Criteria, Regulations and Policy

--Criteria for Water Quality, Volume I (Proposed) U.S. EPA, October 1973
--Water Quality Information, Volume II (Proposed), U.S. EPA, October 1973
--Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, U.S. EPA, March 1974
--Regulation for the Disposal and Storage of Pesticides and Pesticide Containers, 40 CFR Part 165
--EPA Policy to Protect the Nation's Wetlands, Administrator's Decision No. 4
--Navigable Water, Procedures and Guidelines for Disposal of Dredged or Fill Material, 40 CFR Part 230
--Latest regulations prepared by EPA pursuant to Section 1424 (e) of the Safe Drinking Water Act regarding Federal projects in a recharge area of an aquifer designated as a sole source aquifer
--Amended FIFRA Act. The Federal Environment Pesticide Control Act of 1972 (FEPCA)
--Thermal Processing and Land Disposal of Solid Waste Guidelines, 40 CFR, Parts 240, 241

Consistency with Other EPA Programs

--Statewide Water Quality Management Plans "208" plans
--Areawide Waste Treatment Management Plans ("208" Plans),
--Water Quality Management Basin Plans (306(e)" plans), 40 CFR Part 131
--National Pollutant Discharge Elimination System permits, 40 CFT Part 135
--State Air Implementation Plans, 40 CFR, Parts 50 and 51
--State/EPA Agreement, and identified priority environmental problems

Table 3B: Rating Forest Service EISs

Category EU: Environmentally Unsatisfactory

General Criteria (from 309 Review Manual)	Specific Criteria for Land Management Plans
a. Where it is highly probable that a violation of standards will occur. Federal, State, and local standards are included; also includes EPA regulations and guidelines	.Violations of water quality standards, including noncompliance by Federal facilities with requirements for pollution abatement and control (section 313); ..violations of water quality criteria for the uses designated in standards; ..violations of flow requirements required by water quality standards; ..violation of State antidegradation provision or EPA's antidegradation policy; ..violation of State mixing zone policy; ..violations of air quality standards, including requirements for prevention of significant deterioration. .Violation of informational guidelines, such as those for non-point source control (304 (e)).
b. Where a Federal agency violates its own substantive environmental requirements.	.As applicable
c. Where there is a violation of an EPA policy declaration	.Violation of EPA's Statement of Policy on Protection of Nation's Wetlands (38 FR 10834).
d. Where ther are no applicable standards or where applicable standards will not be violated but there is potential for significant and severe environmental degradation: 1. which could be mitigated by other feasible alternatives, or	.Where adverse environmental effects are beyond EPA's jurisdiction and expertise (e.g., historic site, wild and scenic rivers), but there exists a feasible alternative (i.e., one that would substantially accomplish project purposes) which would significantly reduce adverse environmental effects.

Table 3b: (Continued)

2. which relates to EPA's area of jurisdiction or expertise.	.Where aquatic biota, water supply, or recreational areas are threatened, but no 404 permit is involved.

Category 3: Inadequate

General Criteria (from 309 Review Manual)	Specific Criteria for Land Management Plans
a. Insufficient information to permit a reasonable review of project features, thus precluding evaluation of project effects on EPA standards regulations or policies.	.Inadequate description of water quality parameters and their effects on uses (e.g., aquatic biota, water supply). .Inadequate description of plan purposes, benefits and costs, implementation techniques, and other features necessary to allow comparison of project effects with area Water Quality Management Plans (and, perhaps, Air Quality Maintenance Plans).
b. EIS's which, whether intended or not, are overview EIS's covering a broad class of actions for which the initiating agency either does not intend to prepare detailed project-by-project EIS's, or where the inadequate rating, coupled with specific comments, would substantially aid the initiating agency in its useful project-by-project EIS's.	.Plans which have individual components (timber, range, etc.) not adequately described to determine local effects on water quality, aquatic biota, or other areas of EPA jurisdiction and expertise.

Category ER: Environmental Reservations

General Criteria (from 309 Review Manual	Specific Criteria for Land Management Plans
a. Reservations exist concerning the environmental effects of certain aspects of the proposed project.	.Rare natural resources could be directly or indirectly destroyed by implementation of the plan and these resources are unprotected by Federal or state regulations. .Long-term effects of proposed actions are serious and have not been adequately considered. .Further study of alternatives to or modifications of the plan is required.

III. IMPACT IDENTIFICATION AND ASSESSMENT

The purpose of this chapter is to offer technical guidance and reference material necessary to evaluate impacts of national forest land management actions. The chapter is arranged according to the several impact categories (for which EPA is responsible), and further organized to address the major areas of Forest Service actions in three subsections. "Sources of Impacts" (1) identifies types of activities and the nature of potential impacts which they may cause. "Review of Impact Quantification " (2) deals with the appropriateness and validity of techniques to estimate various environmental effects that may result from forest land uses. The "Assessment of Impacts" (3) sections should be used as a guide to formulate comments on a land management plan and accompanying EIS, and in assessing alternatives and mitigation measures. It should be emphasized that not necessarily all of the following impact analyses will be included in each land management plan EIS. Individual forests will include unique problems, and the EIS scoping process may further limit the analyses presented in the EIS. However, care should be taken to assure that where certain issues are covered by reference to other EISs or are tiered with other analyses, that these responsibilities are faithfully carried out, and appropriate summaries offered.

All Federal agencies must follow CEQ's regulations to implement the procedural provisions of NEPA. The regulations are designed to make the NEPA process more useful to decisionmakers and the public; to concentrate environmental analyses on significant issues; to reduce paperwork and delays; and to produce better decisions.

It is important in review of the draft EIS to consider several major issues which relate to its usefulness and effectiveness, and which are stressed in the NEPA regulations. These include:

> Is the EIS understandable? NEPA policy requires that EISs "shall be concise, clear, and to the point . . ." (40 CFR 1500.2(b)). Also, "Environmental impact statements shall be written in plain language . . . so that decisionmakers and the public can readily understand them." (40 CFR 1502.8).
>
> Are differences among alternatives apparent and addressed both quantitatively and qualitatively? The EIS "should present the environmental impacts of the proposal and alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options . . ." (40 CFR 1502.14).
>
> Is the no action alternative defined and evaluated? Due to the nature of Forest Service land management actions, it is especially important that the basis for the no action alternative be clearly stated. For certain actions covered by a land management plan "no action" could mean doing nothing while for others it may represent a continuation of current land management practices over the planning period. These distinctions must be made.

Does the EIS contain a complete, well developed summary? Care should be taken in reviewing the summary that it fully and accurately addresses the issues in the body of the EIS and stresses "the major conclusions, areas of controversy (including issues raised by agencies and the public) and the issues to be resolved (including the choice among alternatives)." (40 CFR 1502.12).

While this chapter addresses substantive issues which may be relevant to EPA's review of draft EISs, the reviewer may also find the information useful in carrying out other NEPA responsibilities, in particular (1) participation in the scoping process to determine the scope of issues to be addressed and identify significant issues related to the proposed action and (2) participation as a cooperating agency at the request of the Forest Service to prepare environmental analyses or make available staff support in areas of EPA's special expertise.

III.A. Review of Water Quality and Quantity Impacts

Most land uses and land management activities have the potential to affect the quality and sometimes the quantity of water that runs off or through the watersheds of National Forest System lands. The degree of adverse impacts depends various factors, including nature and extent of human activities in an area, physiographic and climatic conditions and the degree to which potential problems are recognized and appropriate protective measures taken. This section examines what is probably the most important area of EPA concern related to forest land management, the broad category of water-related impacts. The water quality implications of solid waste management and pesticides are addressed largely in separate sections dealing with those impact categories.

III.A.1. Sources of Impacts

The variety of land use activities which take place on national forests may have both beneficial and adverse impacts on water quality and quantity. The reviewer should use this section as an aid to understanding the kinds of impacts which may result from land management plans and programs under the responsibility of the U.S. Forest Service.

Types of Water Pollutants

Generally, surface watercourses and ground water in forested areas are of high quality. However, management activities and land uses can cause temporary or longer-lasting deterioration of water quality. The following paragraphs describe the types of water pollutants of concern to the reviewer in evaluating Forest Service Land Management Plans and EISs.

Sediment. Sediment is the most obvious pollutant from forest management activities. Production of sediment from undisturbed, forested watersheds is normally very low. Most of the uses of national forest lands have the potential to cause erosion and subsequent sedimentation of surface water courses. The nature and extent of sediment pollution are dependent on a complex set of environmental and other variables. Besides their physical effect on the water quality by increasing turbidity, sediments may also carry chemical and bacteriological pollutants into streams. Overall this criterion is often the most significant indicator of ecological integrity and general well being of streams.

Nutrients. Nutrients, primarily nitrogen and phosphorus, may accompany runoff in the forest environment. Sources may be natural or created by human activity. Applications of fertilizers and fire retardants in connection with silvicultural management can result in nutrients being transported to streams. Also, erosion, timber harvesting, and burning (prescribed or otherwise) interrupt natural nutrient cycling and may contribute to increased nutrient loadings in surface waters. Whether a pollution hazard results depends on the nutrient levels, stream uses, and other factors.

Organic matter. Organic matter is present in the forest in great quantities. In the absence of natural or human-caused disturbances, the amounts of organic matter introduced to streams in forested watersheds are not usually high enough to cause objectionable pollution. All phases of forest management can generate residues of leaves, bark, slash, and other herbaceous and woody organic matter which may be transported to water courses and cause water quality degradation. Once in the aquatic system, such organic matter not only has adverse physical impacts but also exerts an oxygen demand which can have deleterious effects on stream ecology.

Bacteriological pollution. Bacteria and other microorganisms are present in soil, vegetative debris, and human and animal wastes. While most of these are harmless, pathogenic organisms may be transported to streams along with soil bacteria. Bacterial pollution usually emanates from diffuse, nonpoint sources of overland runoff.

Pesticides. Although pesticides are treated in a separate section of this manual, they should be recognized as potential water pollutants in conjunction with forest management activities. As used here, the term pesticides includes silvicides, herbicides, insecticides, fungicides, rodenticides and any other chemical (or biological) agent used to control undesirable species of plants or animals. Pesticides applied in the forest environment may enter surface waters directly if precautions are not taken to limit applications along streams and indirectly via erosion and surface runoff. The toxicity, persistence and hazard of different pesticides vary greatly and must be assessed on an individual basis. The value of integrated pest management should be stressed and encouraged by EPA in reviewing land management plan EISs where appropriate.

Thermal pollution. Thermal pollution in the context of forest management results from the removal of trees and other vegetation along streams, exposing the water surface to direct sunlight and solar warming. The effects on water temperature can be substantial. Elevated temperatures are of concern with respect to effects on physical, chemical and biological processes in an aquatic ecosystem.

Other pollutants. The above-described categories of pollutants are those normally associated with forest land uses and forest management. In special circumstances other pollutants may be important. The land management plan and EIS should identify any conditions such as mineral leasing activities which could result in other forms of pollution.

Impact-Producing Activities and Land Uses

Forest Service land management plans and EISs cover a range of land uses and activities, all of which can potentially affect water quality. Table 4 lists the major areas of Forest Service responsibility, various land management activities and the water quality effects which may be associated with the various activities. Generally, the reviewer will be concerned with water quality impacts stemming from disturbance of the natural soil and vegetative cover. Where application of fertilizers, pesticides and other chemicals or disposal of wastewater is involved, effects of these substances on the aquatic environment must also be considered.

Identification of water impacts necessitates consideration of:

1. the nature of the land resource involved, that is, topography, climate, soils, geology, groundwater hydrology, etc.;

2. the nature of the water resource involved, including hydrology, water quality, water quantity, water uses and other factors;

3. the nature of the land use activities which may affect the land and water; and

4. the nature of the physical, chemical and biological processes involved, such as those influencing erosion, sedimentation and changes in water quality or quantity.

The nature of potential water impacts is determined by the interactions among these categories. Knowing that tractor logging will be employed to harvest clearcut timber, for example, is not a sufficient base for identifying and characterizing water quality impacts, which depend also on slope, soils, precipitation patterns and a host of other factors. The following section presents more detailed guidance on the information and techniques necessary for adequate quantification of impacts that are generally identified in Table 4, as well as rules of thumb concerning the effects of various factors on pollution potential.

Table 4: Summary of Forest Service Land Management Activities and Nature of Potential Water Quality Impacts

Activity or Land Use	Nature of Potential Water Quality Impacts
Timber	
Silvicultural Activities	
Thinning (precommercial and commercial)	Disturbance of soil and organic layer by equipment may increase erosion potential
Herbicide and other pesticide applications	Chemicals may be introduced directly or transported to watercourses
Fertilizer and fire retardant applications	Nutrients may enter watercourses and promote undesirable algae growths
Prescribed burning (for slash disposal or site preparation)	Burning may increase erosion potential; sediments and nutrients may be eroded into streams
Harvesting Activities	
Felling, log handling and residue disposal	Exposure and compaction of bare soil may lead to erosion and sedimentation; bark, slash and other organic debris may reach watercourses and exert an oxygen demand with decomposition; removal of canopy trees near streams may increase solar radiation and raise stream temperatures; removal of timber may increase peak runoff rates
Road Construction	Road construction is usually the single most important cause of erosion and sedimentation in forested areas; bank instability and mass soil movement may result from road cuts.
Range	
Domestic animal grazing	Soil compaction, reduction of vegetative cover, erosion, fecal contamination and sedimentation of streams may be attributable to overgrazing on range lands.
Recreation	
Camping and picnicking areas	Intensive use of recreation sites may increase erosion and sedimentation due to soil compaction and damage to vegetation; sanitary wastes may adversely affect water quality if improperly managed.

Table 4 (Continued)

Activity or Land Use	Nature of Potential Water Quality Impacts
Hiking trails	Hiking trails may be highly susceptible to erosion, especially on steep slopes and areas with thin soil and sparse vegetation; careless disposal of wastes may result in stream pollution.
Off-road recreational vehicle (ORRV) use	ORRV's may cause significant soil disturbance and damage to vegetation, resulting in greater potential for erosion and sedimentation.
Wildlife and fish	Management activities specifically for wildlife and fish generally improve or have no effect on water quality.
Wilderness	
Recreational use (primitive camping, hiking, etc.)	Soil erosion, compaction, and sedimentation may be associated with wilderness hiking and camping, depending on the intensity of use.

III.A.2. Review of Information Adequacy and Impact Quantification

The activities undertaken by the Forest Service in managing National Forest Lands have the potential to impact water quality and quantity to varying degrees. Careful planning and management offer significant opportunities to prevent or reduce the pollution hazard, in many cases to the point where further reductions are not feasible without curtailing activities completely. In such instances, the reviewer has to judge whether the residual impacts will cause violation of applicable water quality standards, existing water quality or otherwise impair the intended use of the water resource. Also, the reviewer may frequently be faced with evaluation of impacts which cannot be quantified except in a very general descriptive fashion. In these situations, the importance of potential impacts may have to be judged by: the nature of effects experienced under similar circumstances, the value, quality and sensitivity to degradation of the water resource involved, and changes in water resource related use demands expected within the affected area.

Information Review Guidelines

The following guidance should aid the reviewer in determining the adequacy of information in the EIS as a basis for impact quantification.

Nature of the Land Resource. Certain information and data concerning the nature of the land resource are applicable to the assessment of all forest land uses and management activities. The kinds of information having relevance to impact evaluations are discussed below and should be contained in the land management plan or accompanying EISs.

Topography: Topographical information includes slope length, steepness, aspect and elevation. Slope length and steepness directly influence the velocity of surface runoff and thus sediment-carrying capacity and erosion potential.

Elevation and aspect affect erodibility indirectly through their influences on soil and vegetation development. This information is readily available from USGS maps but must be interpreted in the context of other site factors and the proposed land management activities in order to be useful for impact assessments. For silviculture, it is important that topographical characteristics are fully described in all areas where logging, road construction and other activities would take place. Similarly, topographic features in areas for recreation, grazing and other uses should be described. Factors that should be kept in mind in reviewing the information include:

- Erosion potential increases with increasing slope length and slope steepness
- The majority of mass soil movements (landslides, mud flows, and creep) occur on slopes greater than 35° or so; sliding may be imminent on such slopes if forces holding soil in place are interrupted (as by clear-cutting or road construction, for example)

.. Sites at higher elevations are apt to be more erodible than lower sites due to poorer soil development and differing vegetation

.. Aspect (exposure) may affect organic content of the soil, and thus erodibility; some studies have shown erosion rates to be higher on south-facing slopes due to frost heaving and sparser vegetation.

Soils: The properties of soils must be considered in assessing potential water quality impacts of forest land uses. Most important are such characteristics as texture and aggregation, nature of parent material, organic matter content, chemical properties and moisture content. The reviewer should make sure that information on soils is included in the land management plan and EIS for all areas likely to be disturbed by the proposed activities. Examples are areas to be logged, corridors for proposed logging or other access roads and proposed camping or other recreational development sites. Also, local soil conditions should be investigated in detail if subsurface sewage disposal systems are to be installed in connection with recreational facilities construction. Sources of information on soil characteristics may include the Soil Conservation Service, U.S. Geological Survey and the Forest Service itself. Several rules of thumb regarding the influence of soil properties on potential erosion hazard and water quality impacts follow:

.. Resistance to erosion normally increases as the organic content of soils increases, due to its binding effect on holding soil particles together

.. Silts and very fine sands are more vulnerable to detachment and transport than larger or smaller particles, but become less erodible as the proportion of sand and gravel or clay increases

.. Erodibility is inversely related to permeability (e.g., soil compaction by heavy equipment increases runoff and the potential for erosion.

The relationships between soils and erosion are described in greater detail in Forest Harvest, Residue Treatment, Reforestation and Protection of Water Quality, Chapter 4 (EPA 910/9-76-020). Good discussion of soil and other factors affecting surface erosion and mass wasting processes, as well as evaluation procedures, is also contained in Logging Roads and Protection of Water Quality, the section on Route Planning and Reconnaissance (EPA 910/9-75-007).

Precipitation: Although temperature, wind, humidity, solar radiation and other climatic factors have effects on erosion, precipitation characteristics are the most important. Precipitation and subsequent runoff provide the energy for the detachment and transport of soil particles. The intensity and amount of rainfall, both during short-term events and over longer periods, are key indicators of potential pollution problems resulting from forest disturbances. The nature of information that should be presented in an EIS depends on the methods used for quantifying or describing potential erosion problems. Some of the empirical approaches to estimating soil loss include factors based on certain characteristics of precipitation. Seasonal variations in precipitation and associated effects on soil moisture content may be especially critical in planning and scheduling of land use activities. General guidelines concerning precipitation are given below:

.. precipitation usually causes little or no overland flow in undisturbed forests, particularly in the East, and thus low rates of erosion, except under conditions of excessively high rainfall.

.. Soil mass movements are most likely to occur under high soil moisture conditions and during abnormally heavy rainfall.

Vegetation and Cover: Vegetation has several major effects in reducing erosion, among them (Schwab, et al. 1966):

1. Interception of rainfall by absorbing the energy of the raindrops and thus reducing runoff,
2. retardation of erosion by decreased surface velocity,
3. physical restraint of soil movement,
4. improvement of aggregation and porosity of the soil by roots and plant residue,
5. increased biological activity in the soil, and
6. transpiration, which decreases soil moisture, resulting in increased storage capacity.

Existing vegetative cover as well as planned modifications to the cover should be described in the land management plan. Of special concern is the nature of vegetation in stream-side areas, in areas where various disturbances would occur, and up- and down-slope from such areas. Information on vegetation type and density may be used, with other data, to make quantitative estimates of soil loss or to judge the ability of areas to resist erosion.

Nature of the Water Resource. The planning and environmental assessment of national forest land uses require sufficient knowledge and understanding of existing stream, lake, and other water body characteristics to: (1) establish baseline conditions from which potential changes can be predicted or measured, (2) identify water resources likely to be impacted by specific activities, and (3) determine the relative sensitivities of various water courses and water bodies to pollution. The types of information required can be categorized generally as water quantity, that is, relating to the hydrology of the stream systems of concern, and water quality, dealing with the physical, chemical, and biological characteristics of the water as well as the associated legal and institutional requirements. Guidance for reviewing the adequacy of such information follows.

Water Quantity (Hydrologic) Information: The reviewer should expect the EIS to characterize the physical nature and condition of streams in the planning area and to describe the hydrology with respect to runoff and its typical variation throughout the year. For streams near or downstream from areas of potential disturbance due to silviculture, grazing, or other activities, descriptions of the following are relevant to impact assessment:

Nature of the stream bed and banks - Which streams or what proportion of the streams are characterized by stable beds of rock and gravel? By erodible sands and silts? Are stream gradients steep or relatively flat? What are the conditions of stream banks, which may range from very stable and well vegetated to highly erosion-prone due to undercutting, meandering, cohesionless or silty soils, or poor vegetative cover? The Forest Service and several states have stream classification systems incorporating these characteristics (described in Processes, Procedures, and Methods to Control Pollution Resulting from Silvicultural Activities, EPA 430/9-73-010, Section 4.1.4).

Stream flow and variations - Are the streams intermittent or perennial? What are the characteristics of peak flows, and what times of year do they usually occur? Do flood hazards exist downstream from areas to be logged? What are the low-flow characteristics of perennial streams?

In many cases the kinds of information alluded to above will be presented in basically qualitative or descriptive terms. However, more quantitative data on flood flows and frequencies and other factors is necessary for actual design of drainage structures, river crossings, and other facilities. Although such information may not have been developed at the EIS stage, the reviewer should expect the EIS to indicate the criteria that would be applied to the location, sizing, spacing, and installation of drainage, flow control, river crossing and other structures based on stream channel and flow characteristics.

Water Quality Information: One of EPA's fundamental concerns with respect to uses of national forest lands is the protection and enhancement of water quality. Due to the nonpoint nature of pollutants emanating from the forest environment and the difficulty in predicting the magnitude of impacts, the review process must focus mainly on the prevention and reduction of pollution to the greatest feasible extent, rather than on allowable pollutant loads or concentrations. EPA's "Best Management Practices" (BMP) approach recognizes that nonpoint source pollution cannot be dealt with in the ways traditionally applied to point source discharges.

The adequacy of water quality information can be judged by the extent to which it fulfills two basic purposes: (1) provision of a suitable baseline from which future changes can be predicted or actually monitored and, more importantly, (2) provision of a means for determining differing vulnerability or sensitivity to degradation (due to stream uses, biota present, or other constraints). Pertinent water quality information includes:

.. Existing water quality and quantity - Results of water quality surveys that have been carried out on streams in the planning area should be summarized verbally and in tabular form. The most critical parameters are dissolved oxygen, suspended solids, turbidity, coliform bacteria, nutrients, and pesticides. Historical trends and effects of past disturbances should be described, if data are available, including trends in stream flow.

.. Existing stream classifications, standards, and uses - Classifications and corresponding EPA-approved State water quality standards should be delineated for water courses and water bodies in the areas of concern. The reviewer should be familiar with the State's antidegradation policy as well as any regulations having specific applicability to silviculture or other forest activities. Water and stream uses should be identified as well, particularly those requiring high quality such as water supply, water-contact recreation, and fishing. Further designation as sensitive or critical areas or inclusion in state or federal scenic and wild river programs should be noted, and compliance with the floodplain management and wetlands protection Executive Orders assured.

.. Existing stream biota - Information on fishery resources is essential. As a minimum requirement, an inventory of the species present and description of their economic or recreational importance are necessary. The U.S. Fish and Wildlife Service and state fish and wildlife agencies are sources of such information. In addition, the EIS should contain information on, and the reviewer should be familiar with, critical water quality and habitat requirements of fish and other sensitive species. Often salmonids (salmon and trout) are of major concern with regard to maintenance of water quality in national forests, and sedimentation of spawning gravels, reduction of dissolved oxygen and increases in water temperature are the greatest hazards posed by silviculture and other activities in the national forests. For detailed guidance, refer to Water Quality Criteria 1972 (National Academy of Sciences, 1973). Evidence should also be provided which indicates compliance with the consultation requirements of the Fish and Wildlife Coordination Act as well as possible impact on any endangered species or supportive habitat.

.. Water quality management plans (Section 208 and Section 303(e) plans) - All areas are or will be included in 208 or 303(e) water quality management plans, unless the State certifies that particular water quality problems do not exist or are not likely to develop (40 CFR 130.11 (b)). Information contained in the plans on nonpoint sources of pollutants and control measures relevant to the national forest areas should be referenced in the EIS.

.. Point sources of wastewater discharge - Any existing or proposed point sources of pollution in the vicinity of the forest planning area, including discharges from campground sanitary facilities or other government buildings, should be identified and characterized and NPDES permit conditions described.

The information presented should be sufficient to give the reviewer an understanding of the present levels of water quality and the relative importance and value of the various water resources in the planning area. Information should be quite specific for larger streams while more general observations may suffice for headwater tributaries and intermittent streams known to have exceptionally high quality. If the EIS has omitted consideration of any of the types of information described above, the reviewer should request that further documentation be provided.

Nature of Proposed Activities. The potential for water pollution and other adverse impacts depends a great deal on the nature of proposed activities and land uses and the interactions between those uses and the land and water resources. This section discusses the types of information that are necessary to adequately characterize various activities on national forest lands. Also, the material is a guide to understanding the significance of site characteristics in relation to the activities and attendant pollution hazards.

Timber: Activities associated with timber resources can be grouped into three main categories of silviculture, harvesting, and road construction. The silviculture category includes thinning, pesticide, fertilizer and fire retardant use and prescribed burning. These can also be termed intermediate practices whose purpose is to increase productivity and quality of the growing forest. Information presented in the forest management plan should address the issues of how, when and where such activities will be carried out, specifically:

.. Amounts and locations of land areas on which the various practices would take place.

.. Nature of the terrain, especially slopes, that would be subjected to thinning and other practices.

.. Methods proposed for thinning, including equipment requirements and potential site disturbance, means of disposing slash and merchantable material, scheduling and frequency of entry into stands.

.. Methods proposed for applying pesticides (broadcast versus hand selection and application of herbicides, for example), including description of special precautions near water courses or other sensitive areas, if any (pesticide use may be covered by a program EIS, in which case the document should be referenced).

.. Methods proposed for fertilizer applications, including special precautions to protect water quality (forest fertilization is practiced mainly in the Southern pine and Pacific Northwest Douglas-fir regions at present).

Harvesting activities involve the felling, yarding and transport of timber from the forest and disposal of residues left after cutting. Regeneration of cut-over sites, by either natural or artificial methods, is not actually a harvesting activity but will also be considered since it is often dependent on the harvesting and residue disposal methods employed.

Four basic harvesting systems are used in the U. S.: (1) clearcutting, (2) seed tree, (3) shelterwood, and (4) selection. With site conditions being equal, the amount of soil disturbance generally decreases for the systems in the order listed. Characteristics and applicability of the methods are as follows (U.S. EPA, 1973):

Clearcutting:

- Virtually all trees (or all trees larger than specified minimum size) removed from harvesting area.

- Applicable to even-aged management of intolerant or subclimax species, including shortleaf and loblolly pine in the South, red and jack pine in Lakes states, red and white spruce and balsam fir in Northeast, lodgepole pine in Rocky Mountains and Douglas-fir in Pacific Northwest, among others.

Seed Tree:

- Most trees removed with a few of the most desirable trees left as a seed source and harvested after reproduction is established.

- Applicable to even-aged management of light-seeded species that require minimum competition and bare mineral soil for establishment, such as longleaf, loblolly, slash and shortleaf pine in the South.

- Potential for erosion and sedimentation similar to clearcutting.

Shelterwood:

- Trees removed in a series of partial cuttings over a fraction of the rotation; regeneration is established before the final harvest cut.

- Applicable to even-aged management of heavy-seeded and intermediately tolerant species, including Appalachian and Central hardwoods, and white and red pine in the Lakes States. Even-aged management by shelterwood cutting is being increasingly employed in hardwood stands of northeastern national forests as well.

- Used mainly on flatter ground where tractors can operate.

- Sediment generation potential may be less than for clearcutting or seed-tree methods.

Selection:

- Individual or small groups of the oldest or largest trees removed periodically.

- Adapted to maintenance of all-aged forest and species tolerant of shade and competition.

- Operations normally restricted to sites where tractors can be used, although cable logging of selection cuts is sometimes used in the West.

- Slash volumes considerably less but site disturbance necessary more frequently than with other harvest systems.

- Often applied to sensitive areas where clearcutting would be undesirable for aesthetic or water quality reasons, such as along streams and roads or near recreational areas.

Information on not only the harvest methods but also the logging systems is necessary for impact assessment. The three basic methods of primary log transport are tractor, various cable systems and aerial (helicopter or balloon). These can differ quite substantially in their applicability to the harvesting methods, road requirements, topographical (slope) constraints and amount of site disturbance. Table 5 compares several logging methods on the basis

Table 5 : Characteristics and Potential Impacts of Various Logging Methods

Logging Method	Use	Road Requirements	Nature and Relative Amount of Site Disturbance
Tractor (rubber-tired and crawler skidders)	For clear or partial cuts on slopes less than 30%; most common harvest method in Northeast and South, but also used in West; less expensive than other methods	Dense network of logging roads and skid trails necessary; more than for other systems	- Compaction, exposure, and displacement of soil - Soil disturbance likely over 20-30% or more of logged area - Generally more damaging than cable methods - Various attachments may be used to reduce contact of logs with ground, thus reducing disturbance
Jammer	For uphill yarding of clearcuts on slopes up to 55%	Fairly intense system of roads generally parallel to contours is required; maximum spacing about 400 ft.	- Disturbances result primarily from log skidding - Soil may be exposed and compacted over 15-20% of clearcut area - Soil disturbance generally less than that caused by tractor logging, but more than for other cable methods
High Lead Cable	For uphill or downhill yarding; suitable for clearcuts only; 30-70% slopes	Road requirements are less than for above methods; maximum yarding distances are approximately 1,000 ft. uphill and 500 ft. downhill	- Soil compaction and disturbance may occur on up to 15% of area - Partial suspension of logs tends to reduce soil disturbance by skidding - When logs are pulled uphill toward boom, skid paths tend to fan out and disperse surface runoff

Table 5 : Characteristics and Potential Impacst of Various Logging Methods

Logging Method	Use	Road Requirements	Nature and Relative Amount of Site Disturbance
High Lead Cable (continued)			- More landings are required than with skyline systems
Skyline Cable (numerous types)	For yarding up or down hill and laterally over short distances; used principally on clearcut operations but also applicable to certain partial cuts	Road requirements may be as little as 1/3 those necessary for high lead logging and 1/10 those for tractor logging; yarding distances of 3,000-4,000 ft. are possible	- Logs are usually lifted off the ground, thus minimizing soil disturbance except at felling, yarding, and loading areas - Erosion potential is less than with tractor or other cable methods
Balloon and Helicopter	For logging of steep or inaccessible areas; high concentrations of merchantable timber are generally required to justify use; used principally in the Northwest	Road density is held to a minimum because of the long yarding distances and versatility of the methods	- Amount of soil disturbance is the least of all logging methods - Helicopter logging requires large landing and yarding areas which may contribute to erosion

of such factors and can be used as a guide in reviewing EIS information on timber harvesting. Figure 2 illustrates the optimum distances and slopes for logging systems in use in the northwestern United States. Chapter 3 in Forest Harvest, Residue Treatment, Reforestation and Protection of Water Quality (James M. Montgomery, Inc., 1976) gives more detailed descriptions of the various log transport systems.

The EIS must indicate the harvesting and logging practices to be used as well as the nature of pollution control measures that will be employed. Although detailed site-by-site descriptions may not be appropriate at this stage, it is important that categories of activities are characterized for the planning unit. The information should identify:

.. Types of harvesting methods (e.g., clearcutting, selection cutting, etc.) and the land areas involved for each.

.. Types of logging systems to be employed with the various harvesting methods and areas.

.. Typical and maximum sizes of areas which will be harvested at one time.

.. Methods for managing timber harvest activities near streams and other sensitive areas such as steep slopes and wetlands.

.. Scheduling and duration of harvest activities.

.. Methods for residue disposal (chipping, burning, and yarding unmerchantable material for example).

.. Methods for regeneration, including site preparation measures (e.g., scarification, burning, or herbicide treatment).

An EIS which contains these kinds of information should convey a good overall understanding of the timber-related aspects of a land management plan. The reviewer needs to insure that the basic methods of harvest, logging, residue management and regeneration or reforestation are discussed. The potential water quality significance of timber activities is to a degree inherent in the nature of the activities but also dependent on interactions with the land and water resources. Land and water data should be integrated sufficiently with information on timber activities so that critical pollution hazards can be identified and the suitability of activities to site conditions properly assessed. For example, clearcutting and tractor logging are likely to result in unacceptable erosion and sedimentation on fairly steep, unstable slopes but might be carried out with minimal problems on gently rolling or level terrain.

Roads are apt to be the principal source of environmental problems such as sediments in forest lands, especially when improperly constructed or located in steep or unstable topography. Road requirements are closely related to the harvest and log transport mehtods chosen, as described in Table 5. It is often difficult and costly to correct erosion and sedimentation problems from logging roads after they occur. Careful location and design along with incorporation of adequate drainage and stabilization features can prevent or minimize water quality impacts of roads. Such an approach is increasingly important as logging takes place in less accessible areas that present greater pollution hazards and construction problems.

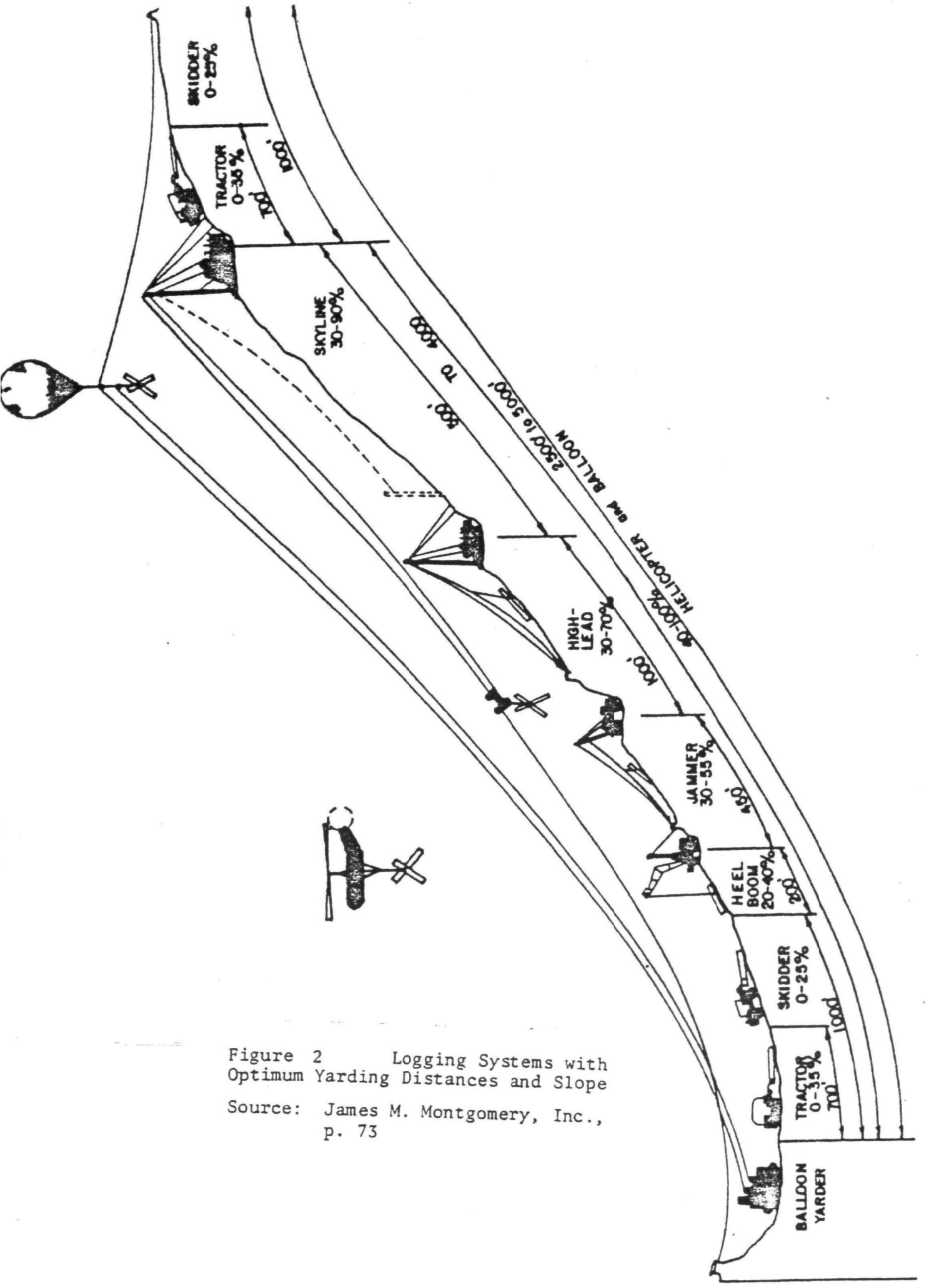


Figure 2 Logging Systems with Optimum Yarding Distances and Slope

Source: James M. Montgomery, Inc., p. 73

Section 8 (b) of the National Forest Management Act requires that any road constructed in connection with a timber contract or other permit or lease be designed with the goal of reestablishing vegetative cover on the roadway and disturbed areas within ten years, unless the necessity for a permanent road is set forth in the forest development road system plan. The EIS should indicate whether proposed roads are to be temporary or permanent, provisions that will be made to revegetate temporary roads and the design, construction and maintenance methods that will be employed for permanent roads.

Information describing forest roads should include soils engineering, geology, forest engineering, silviculture, socio-economic, historical, and others. These specialist areas will be involved in route planning during which road needs and locations are generally identified, route reconnaissance including data collection and field investigations for alternative corridors, and design of the roads, appurtenant structures and mitigating measures. Generally, the EIS for a land management plan will be developed before details of road location and design are specified. The amounts of field data available on alternative corridors will depend on the extent to which such reconnaissance is conducted in conjunction with planning of timber management activities. Whether or not detailed field investigations have been completed for areas where roads are proposed, there still is a variety of information that the EIS should contain relating to road construction and impacts, including:

- Estimates of road length, type (permanent versus temporary), spacing, stream crossings and general layout for proposed and alternative harvest/logging methods and areas.
- Description of erosion control measures to be employed.
- Description of criteria used in choice of road density and route location.
- Description of plans and procedures for road maintenance and abandonment.
- Assessment of likely secondary impacts associated with providing access to new areas.
- Description of any special or unique problems such as location or impact on a flood plain or wetlands area, or scenic or wild river.

Assessing the adequacy of this information involves judging whether reasonable assurances are given that:

- Road construction will be held to a minimum given the constraints imposed by topography, sensitive areas and logging methods.
- Roads will be located so as to avoid, to the extent possible, areas presenting high-risks of erosion and mass soil movement.
- Pollution prevention and reduction measures, both structural and non-structural, will represent the best management practices for forest road construction and maintenance.

Table 6 lists some of the considerations in road location, as a guide to reviewing EIS information and impact discussions. The publication Logging Roads and Water Quality (U.S. EPA, Region X et al., 1975) is an up-to-date and quite complete reference document which the reviewer should consult for details on specific approaches to road planning, design, construction and maintenance.

Range: Permitting grazing on forest or grasslands may, over a period of time, cause soil compaction, reduced infiltration rates and vegetative cover, and increased soil erosion. Also, entry of livestock into streams constitutes a pollution hazard. Few studies have been made of the nature and extent of these potential problems. Often grazing systems include various rotation and deferment schemes allowing different areas to go ungrazed for a season or longer. Information in the EIS should describe plans for use of forest lands for grazing, addressing in particular such aspects as:

.. Amounts of land area involved.

.. Present condition of rangelands.

.. History of grazing use and erosion or water quality problems encountered, if any.

.. Nature of proposed grazing systems (rotations, deferment, etc.)

.. Nature of streams in grazing areas and provisions for preventing animals from entering streams, if any.

.. Provisions for periodic inspection to detect incipient erosion, deterioration of cover, or water pollution problems.

Past experience with grazing may be a useful indicator of the potential for adverse water quality impacts. If the land has been used for pasture without incident, then comparable future uses should not result in unacceptable pollution. However, significant changes in the nature of use, animal density or other factors should be carefully observed for possible detrimental effects on water quality.

Recreation: The national forests attract large numbers of visitors for camping, picnicking, hiking, hunting, fishing, swimming, skiing, off-road recreational vehicle use and many other activities. Some of these activities result in high concentrations of people in small areas while others are widely dispersed. In general, areas of heavy use are the most vulnerable to degradation which may lead to erosion, sedimentation and other environmental problems. In addition, the need for proper disposal of sanitary wastes arises in areas subject to intensive use.

Major new recreational developments, such as ski areas or campgrounds, may be subjects of separate environmental statements; if so, reference should be made to such other studies. For recreational activities and land uses that are covered in the land management plan and EIS, the information presented should address:

.. location, characteristics, and proximity to streams of intensive-use recreational sites (campgrounds, picnic areas, etc.)

Table 6 : Topographical Influences on Logging Road Location

Locational Characteristic	Advantages	Disadvantages	Special Precautions
Valley bottom	- Low gradient - Good alignment - Minimal excavation	- Flood hazard - Number of stream crossings - Proximity to stream channels	- Avoid road location in or adjacent to stream channel - Position so as to protect from flooding - Minimize channel disturbance, cuts, and fills at stream crossings; construct crossings at right angles to stream axis - Avoid very flat gradients that would cause ponding of water
Hillside	- No flood hazard - Greater distance to streams reduces potential for sedimentation	- Higher grades - More excavation - Longer slopes - Poor alignment from following grade contours - Exposed cuts and banks - Possibility of soil mass movement	- Avoid steep, unstable, dissected slopes - Stabilize exposed cuts and slopes immediately by seeding, mulching, or other methods - Provide for drainage and dispersal of runoff from road prism - Locate to minimize earth moving
Ridge	- Good drainage - Less excavation - Large amounts of vegetation or logging slash to act as buffer between road and streams	- Poor alignment along dissected ridges - Possibly adverse grades for connecting roads	- Avoid narrow, precipitous ridges - Revegetate cut and fill areas as soon as possible after disturbance - Provide adequate roadway drainage

.. provisions for sanitary waste treatment/disposal areas

.. nature of off-road vehicle use and pertinent regulations for protecting soil, vegetation and water quality

.. methods for monitoring, prevention and control of erosion and sedimentation from recreational use areas

Water pollution from recreational use is largely nonpoint in nature and is likely to be a long-term rather than an immediate problem, caused by soil compaction and deterioration of vegetative cover in camping areas, along trails and at other regularly used sites. Information in the EIS should be sufficient to demonstrate that sensitive areas with steep slopes, erodible soils, or other hazardous features will be avoided, to the greatest extent possible, as sites for recreational development and use. The reviewer should also ensure that any waste water point sources are managed in conformance with the requirements of the National Pollutant Discharge Elimination System.

Quantification Review Guidelines

The state of the art in predicting the magnitude of pollution from silviculture and other forest activities is not well developed. Basically, the available methods deal with the estimation of soil erosion and sediment production and with prediction of thermal effects from removal of trees along watercourses. EPA has published an assessment of nonpoint water quality modeling in wildland management (Forest Service, 1977). Although the report reviewed numerous physical, biological and chemical models, only a few were found to be suitable for use by field personnel in land management planning. Generally, the report concluded that local or regional regression models represent the state of the art, and that their validity and utility cannot be determined without calibration or testing in the environment where they would be used. Also, there are relatively few national forest areas for which a sufficient date base exists for testing and applying many of the modeling techniques. Another major limitation of many nonpoint water quality models is the difficulty or inability to predict pollutant loadings and resulting concentrations in water courses.

The Universal Soil Loss Equation and Musgrave Equation, originally developed for predicting agricultural erosion, have been applied to forest lands in some cases. These equations and their use are described in detail in Methods for Identifying the Nature and Extent of Nonpoint Sources of Pollution (U.S. EPA, 1973). The estimates of erosion and sediment production rates yielded by these equations do not indicate the resulting water quality effects. Predictions of suspended sediment concentrations can be made by a method called First Approximation of Suspended Sediment, which is also described in the above-referenced EPA publication. The method combines hydrologic information (for example, storm flow, base flow and annual flow) with sediment production estimates for a watershed to arrive at suspended sediment concentrations for various flow conditions.

Use of all of these techniques requires data on soil characteristics, topography, vegetative cover, rainfall and other features specific to the area being evaluated. Because silvicultural and other forest management activities often involve large and noncontiguous land areas and diverse environmental conditions, application of predictive methodologies is likely to be difficult. It will rarely be feasible to conduct detailed predictions of erosion and sedimentation for all areas affected by a forest land management program. Studies may rather be carried out on experimental watersheds or sample plots within the management area. The reviewer should recognize that results from study areas may not hold for other forest lands, except in a very general way given similar site conditions. Where feasible, the reviewer should note opportunities to recommend that indicators such as stream bed sedimentation be monitored, and encourage joint review with the state Water Quality Management Program.

An approach to predicting stream temperature changes is also discussed in the previously referenced EPA document. The method enables estimation of the maximum temperature change in a stream as a result of exposure to solar radiation by removing streamside vegetation. The reviewer should refer to Methods for Identifying the Nature and Extent of Nonpoint Sources of Pollution for details on data requirements and use of the method.

Methods for predicting water quality effects of other pollutants, such as pesticides, bacteria and nutrients do not exist. Generally, site-specific studies must be undertaken to monitor water quality changes associated with forest land use activities. Since predictive tools for estimating nonpoint pollution from forest lands are limited, the reviewer should evaluate the management plan and EIS with a view toward: (1) the inherent risks of pollution presented by site factors and nature of proposed activities; and (2) the extent to which the risks will be reduced by application of best management practices and specific impact mitigation measures. The discussions of the nature of the land resource, water resource, and proposed activities in the previous "Information Review Guidelines" section should help the reviewer to recognize those situations posing relatively greater or lesser risks of pollution.

The following discussion reviews ways to mitigate impacts and should help to determine whether reasonable precautions for safeguarding water quality are addressed in the Forest Service Plan and EIS. If quantitative impact prediction methods are employed, such as for estimating erosion and sedimentation rates, they should be documented in the EIS. Conclusions derived from data pertinent to specific study locations should not be generalized for whole management areas or categories of land use activities.

Mitigation Review Guidelines

The reviewer will be required to evaluate potential water quality impacts which are largely nonpoint in origin and likely to be described largely in qualitative terms. Moreover, the impact-producing activities associated with national forest management are apt to be spread out both spatially and temporally. Given these aspects of water quality management in forested areas, it is critically important that EPA's review be concerned with the nature and

Table 7: Framework For Water Pollution Control Practices Used In Connection With Silvicultural And Other Land Management Activities

PREVENTION	REDUCTION
Limiting, through prevention or management decision measures, the generation of conditions that could add materially to the pollution potential. Advance planning to avoid, to the extent feasible, potential problems through identification of, and allowance for: (1) natural hazards such as areas of natural mass earth movement, highly unstable soils, and unstable stream channels, (2) limitations imposed by landform, climate, topography, soil moisture, channel characteristics, etc., (3) land capabilities in terms of soil productivity, vegetation recovery potential, etc. Consistent with overall land management objectives, including due consideration for the other resource values of the area and the technical, economic, institutional and social feasibility and practicality of alternatives: . minimize type and magnitude of disturbance in high hazard areas. . select appropriate operational methods, standards, and equipment with due consideration of relevant limitations . optimize size and shape of areas and the sequence, timing, spacing, and intensity of activities.	Applying physical, biological, or chemical measures to help reduce the unavoidable pollution potential created by activities and/or prevention or potential pollutants to receiving waters. . Erosion Control .. on-site Revegetation Dispersion of concentrated runoff Physical or chemical treatment of the land or temporary soil treatment (mulching, etc.) .. In-channel Debris removal Structural measures . Nutrient Management Prudent use of fertilizers Treatment of forest residues . Pesticides Management Prudent use of pesticides . Water Temperature Control Streamside vegetation management

Source: U.S. EPA, office of Water Planning and Standards, Nonpoint Source Control Guidance--Silviculture, EPA WPD Tech 37-3-77, March 1977.

extent of measures planned for mitigating or eliminating potential quality problems. Judgments as to the appropriateness of such measures should be made according to the relative pollution hazard of the land use and management activities involved, and the sensitivity, value and susceptibility to pollution of the water resources that could be affected.

Mitigation of water quality impacts can be accomplished through application of prevention and reduction practices. Table 7 gives an overview of prevention and reduction practices and guidance for each of the two approaches follows.

Prevention Practices. Prevention practices are generally concerned with careful planning of the nature, location and scheduling of activities to minimize the potential for pollution. As such, prevention practices are decided upon prior to the implementation of any forest land management program. The choices of how, when and where various activities are to be carried out should be made with full recognition of the consequences in terms of either increasing or decreasing the potential for pollution to occur. Usually it is more effective to plan land management to avoid situations conducive to the generation of pollution than to take remedial actions once problems have been created.

Location of Activities: The factor of location has an important bearing on the planning, design, implementation and resulting environmental impacts of all forest uses and activities. Table 8 identifies review considerations relevant to evaluating locational choices in an EIS. Basically, for any activity or land use, the reviewer needs to consider (1) whether the EIS presents sufficient information to differentiate among areas with respect to topography, soils, and other conditions influencing the potential for non-point source pollution, and (2) the extent to which land uses are planned to avoid or minimize activity in areas identified as posing high pollution hazards. If the data are insufficient to characterize the settings for proposed land uses, the deficiency should be reflected in the EIS adequacy rating. Similarly, the reviewer should expect the EIS to state specific criteria that have been or will be used in planning the location of various land management activities to prevent or reduce the threat of pollution.

Scheduling of Activities: The "when" aspect of land and resource management may also influence the potential for pollution. As a pollution prevention practice scheduling generally entails any of the following: limitation or prohibition of activities during certain times of the year or weather conditions, coordination of activities to minimize the extent of soil and other disturbances at any one time, and prompt completion of activities such as residue management, site preparation and reforestation to accelerate the recovery of disturbed areas.

Table 9 outlines some of the ways that scheduling or timing may be applied to various management activities to limit pollution potential. In order to be

Table 8: Guidelines for Pollution Prevention Practices - Location of Activities

Activity/Land Use	Prevention Practices	Review Considerations
Timber		
Road Construction	Avoid high-hazard areas (steep slopes, erodible soils, sensitive stream channels, and areas susceptible to soil mass movements)	Does the data contained or referred to in the EIS demonstrate adequate identification and consideration of physical limitations to road building? Are road location plans and design criteria described in the EIS? To what extent do they indicate avoidance of identified high hazard areas?
Timber Harvesting	Minimize intensity of activities on high-hazard areas, particularly adjacent to stream channels	Does the EIS describe plans for leaving undisturbed buffer strips along stream courses? To what extent will logging and yarding be restricted in such sensitive areas? Are the harvest operations planned to avoid logging of steep, unstable slopes as much as possible?
Fertilizer and pesticide application	Avoid direct applications on or near open water	Do the methods of silvicultural chemical use include specific measures to avoid application near streams and other water bodies?
Recreation		
Camping and picnic areas; hiking trails	Avoid sites susceptible to soil compaction, erosion, and drainage problems	Have the physical characteristics of potential sites for recreational facilities been thoroughly investigated? Does the EIS address trade-offs among alternative sites and adequately state the rationale for selecting the proposed plan?
Off-road recreational vehicle use	Control vehicle use in areas of steep slopes, highly erodible soils, and unstable slopes	Has an off-road vehicle plan been prepared for the forest? Is use of off-road vehicles confined, insofar as possible, to areas that have low pollution hazards?

Table 9: Guidelines for Pollution Prevention Practices - Scheduling of Activities

Activity/Land Use	Prevention Practices	Review Considerations
Timber		
Road Construction	Schedule road construction activities for the appropriate season to avoid adverse runoff and other site conditions	Is scheduling of road construction activities specified in the EIS?
	Schedule stream crossing construction to minimize impacts (may be low-flow condition or depend on fish spawning, for example)	Will the scheduling prevent undertaking construction activities when soil moisture conditions are excessive and provide for suspending activities underway if adverse conditions arise?
	Coordinate excavation and erosion control work to minimize area of exposed soil subject to uncontrolled runoff during heavy rainfall periods	Will the scheduling insure that temporary and permanent drainage facilities are installed as soon as practicable following site disturbance?
	Close roads when not being used for timber activities	
Harvesting and post-harvest activities	Schedule harvesting to control the amount of disturbance in any given watershed at any one time	Do the harvesting schedules provide for temporal distribution of logging activities in given areas?
	Initiate and complete post-harvest operations as soon as possible after logging (particularly regeneration, residue management, and stabilization of disturbed areas)	Will requirements be imposed for site preparation and regeneration activities to proceed soon after logging?
		Will requirements be imposed for prompt stabilization of landings, skid trails, temporary roads, and other disturbed areas?
	Schedule harvesting and post-harvest activities so as to prevent operations on high-hazard areas during periods of high rainfall and runoff	Do the harvesting schedules prohibit or limit activities when pollution potential is high (due to runoff or other site factors)?
		Will use of heavy equipment for logging or residue management (slash piling, for example) be avoided when soils are wet?

Table 9 (Continued)

Activity/Land Use	Preventive Practices	Review Considerations
Silvicultural chemical use (fertilizers, herbicides, and other pesticides)	Schedule applications to take advantage of favorable meteorological conditions	Are criteria for application of chemicals discussed in the EIS? Do the criteria provide for scheduling chemical use when rainfall and runoff and the potential for wind drift are low?
Range		
Grazing	Schedule rotations of grazing lands to prevent excessive soil compaction and deterioration of vegetative cover due to overgrazing	Will grazing programs be adequately monitored and scheduled to prevent overgrazing?
Recreation		
Off-road vehicles	Restrict snowmobile use to times when a certain minimum snow cover is present; implement seasonal or other periodic closures to ORV use, if necessary	Are use schedules for ORV's addressed in the EIS? Will restrictions be instituted during critical periods of the year or if erosion or other problems are observed?

effective, it is important that scheduling be addressed explicitly in the EIS and incorporated into specifications and management directives for various silvicultural and other activities. .In most cases, careful attention to the timing of activities can significantly reduce the potential for water quality impacts with little or no additional cost. The reviewer should insure that schedules for all important activities are established and will be adhered to in accordance with seasonal and other criteria for protecting water quality.

Nature of Activities: The manner in which management activities are carried out can greatly affect the potential for water quality problems. Table 10 describes, for several activities and land uses, some approaches that may be taken in preventing or reducing the likelihood of pollution. The review considerations in Table 10 indicate the kinds of things the reviewer should look for in the EIS to judge whether and how well activities have been planned to reduce the risk of impairing water quality. It is important not only that reasonable prevention practices are recognized in the management plan and EIS, but also that adequate specifications, inspections and other measures will be taken to insure their implementation.

Reduction Practices. Reduction practices are remedial in nature and are applicable to controlling pollution in situations where its occurrence is unavoidable through use of preventive measures. Several such practices are described in Table 11 which is based on best management practice (BMP) information in EPA's Nonpoint Source Control Guidance--Silviculture.

The general functions of reduction practices are protection of exposed soil and retarding movement of runoff and pollutants to water courses. Protection of soil may be accomplished by vegetation establishment, mulching, riprap, paving (roads), physical and chemical treatment and other means. Structural measures such as debris basins, sediment ponds and other drainage structures may be used to control runoff and intercept eroded sediments and other pollutants before they enter receiving waters.

The need for such measures is dependent on the nature and extent of land management activities and on site-specific characteristics of topography, soils, drainage patterns and proximity to streams. It is not necessary or even possible in a land management plan and EIS for all pollution control measures to be specifically identified and located, since some control requirements may become evident only when road construction, logging or other activities are underway. However, it is important that the general specifications and criteria that will apply to the activities are fully described. In sensitive areas, for example, in the vicinity of recreationally or ecologically important streams, the plans should provide for special precautions to protect water quality.

Basically, all areas disturbed to the extent that protective vegetation and litter are removed and bare soil is exposed should be treated to minimize erosion. Planting of grasses with or without mulching, scarification and other physical treatments is applicable to sites such as cut and fill embankments, log landings, intensive-use recreational areas and others where stabilization is necessary but reforestation is not desired.

Table 10. Guidelines for Pollution Prevention Practices - Nature of Activities

Activity/Land Use	Prevention Practices	Review Considerations
Timber		
Road Construction	Minimize the length and density of roads through careful planning and layout, consistent with management objectives Design roads to fit topography and minimize disturbances from cuts and fills	Are road requirements quantified for areas to be harvested? Will roads be laid out in orderly patterns to reduce the construction required? Does the EIS discuss criteria used in determining road density and layout? Have alternative road schemes been identified and considered to reduce construction and associated impacts?
Timber harvest	Adopt low-impact logging methods, particularly in areas with high pollution hazards (skyline and aerial logging cause the least disturbance of the methods currently used) Select logging methods and equipment that are adapted to specific site conditions For cable systems, permit only uphill yarding Fell trees uphill and away from water courses	Are the harvest and logging methods to be used identified in the EIS? Are they compatible with the site conditions? Have harvest systems that would allow a lower road density been considered? Will various operational controls such as directional felling of trees, uphill yarding, and regular inspections of activities be specifically required during timber harvesting operations?
Residue management and site preparation	Select methods for managing slash that minimize the movement and compaction of soil (for example, avoid use of bulldozers with scraper blades)	Does the EIS identify methods that will be used for site preparation and residue management? Will restrictions to minimize disturbance during yarding or other slash handling be placed on logging contractors?
	Minimize accumulation of fuel to reduce the threat and severity of wildfires and associated water quality impacts	Will the proposed residue management contribute to reducing fuel volumes?
Pesticides and other forest chemical usage	Minimize chemical usage through reduced application rates and greater reliance on natural and cultural pest control methods	Are the background and rationale for pesticide use adequately described?

Table 10 (Continued)

Activity/Land Use	Prevention Practices	Review Consideration
Pesticides and other forest chemical usage (continued)	Select pesticides for effectiveness, minimum toxicity, low persistence, selectivity for target species, and low mobility	Have potential alternatives been identified and studied? Do pesticides to be used represent the least harmful options?
Range		
Grazing	Restrict animal entry to stream courses by fencing or other means	Are there provisions to protect stream segments having high water quality requirements from fecal and other pollution caused by grazing livestock?
Recreation		
Intensive-use areas (campgrounds, picnic sites, etc.)	Control level of use to prevent soil and plant deterioration and to allow recovery of damaged areas. Provide for proper waste disposal	Does the EIS discuss management and maintenance plans for intensively used recreational areas? Are the safeguards adequate to protect water quality? Do sanitary and solid waste disposal facilities conform with applicable requirements?

Table 11: Guidelines for Pollution Reduction Practices

Reduction Practice	Application	Advantages	Limitations
Seeding or planting of grasses or other herbaceous vegetation	Bare soil or soil with inadequate vegetative cover, including any areas disturbed by forest management activities	Relatively quick cover. Improves infiltration capacity. Reduces overland runoff.	May require fertilization. May impede reforestation. Not effective in controlling mass soil movements.
Seeding or planting trees	Bare soil or soil with inadequate vegetative cover	Improves infiltration capacity. Reduces overland flow after a litter layer develops	Only effective after several years. May reduce water yields. May require fertilization
Dispersal of runoff (by constructing water bars and dips in roads, energy dissipators at culvert outlets, berms, and benches, for example)	Tractor roads, skid trails, and logging roads	Retards runoff by reducing slope length and area of concentration. Permits infiltration over larger area	Can increase erosion if water directed to unstable areas.
Physical treatment of land surface (contour trenching, furrowing, scarification, etc.)	Areas where soil moisture or rapid runoff inhibits plant establishment and growth	Retards runoff by reducing slope length and increases infiltration. Aids plant establishment	Can lose effectiveness and increase soil loss. High Cost.
Debris removal or dispersal	Stream channels	Reduces concentrations of organic matter. Lessens chance of debris dams, sediment deposits, and subsequent bank erosion	May damage stream banks, bottoms and fish habitat. Moderate to high cost.
Mulching	Bare soils or soils with inadequate cover where slope or soil moisture is critical.	Aids maintenance of soil moisture. Reduces overland runoff. Increases infiltration. Aids establishment of herbaceous vegetation.	May increase BOD load if organic mulches are washed into streams. May increase need for fertilization.

Table 11 (Continued)

Reduction Practice	Application	Advantages	Limitations
Road surface protection (gravel or crushed rock surfacing, asphaltic concrete or bituminous paving)	For steep road segments, stream crossing approaches and permanent or other roads designed for heavy use	Protects subgrade by reducing water infiltration. Eliminates or reduces rutting and road surface erosion.	Decreases time of concentration for runoff. Requires nearby source of suitable construction materials.
Structural measures such as debris basins, sediment ponds, retaining walls, flow retarding structures, culverts, ditches, and others	Stream channels, areas of mass soil movement, and downstream from drainage areas affected by construction, roads, and other activities	Retard water and pollutant movement from land to receiving waters	May cause some sediment pollution during construction. Require periodic maintenance. Moderate to high cost.
Chemical treatment of soil (flocculants or surficants)	Fine textured soils and/or soils which are difficult to wet.	Improves infiltration capacity and reduces overland flow	Effectiveness decreases with increasing clay content for some flocculants. Chemicals may pose pollution hazard.

Reforestation should be carried out on cut-over areas as soon as possible after harvesting is completed, and on other areas which have been disturbed by mining, fire or other natural or man-made causes. Trees can help to maintain slope stability in areas susceptible to mass soil movements whereas herbaceous cover may not. Because tree planting or other reforestation requires several years to become effective in erosion control, interim structural measures may still be necessary for slope stabilization.

Structural measures include a wide variety of devices to intercept and disperse runoff, retain soil and sediment, prevent mass wasting, alter subsurface drainage and otherwise modify surface and ground-water movement so as to reduce erosion and sedimentation. The use of structural measures for reducing pollution from logging, road building and other forest management activities should be addressed in the land management plan and EIS. Location, size and other details would normally be identified in design plans and specifications for the work. However, the Forest Service should generally discuss the kinds of pollution reduction measures that would be employed for particular types of activities and the situations in which they would be applied. Such practices should, as a minimum, be implemented in areas having steep or erodible soils, in the vicinity of streams and in other areas with high pollution hazards.

III.A.3 Assessment of Water Quantity and Quality Impacts

Many of the water pollution and other water-related impacts stemming from forest management and use tend to be variable and often unpredictable with respect to time and space, nonpoint in nature, and quantifiable in only a fairly general way. Due to these factors the reviewer will in many cases not be able to relate water quality impacts to specific numerical standards or criteria. Rather, the more general language of state water quality regulations must also be considered, which requires judgments by the reviewer as to the potential magnitude of impacts. In addition, careful planning of pollution prevention and mitigation measures and flexibility in their implementation become especially important given the uncertainty and inability in predicting some impacts.

State adopted water quality standards form one basis for assessing water impacts. Such standards, however, have been designed to apply primarily to lower reaches of streams which receive point source wastewater discharges. Small headwater streams typical of many in national forest areas are often of high quality and affected by few if any point source discharges. Moreover, water quality in small streams is apt to be highly variable naturally and data are seldom available to establish baseline conditions for interpretation of water quality standards.

Whether or not potential water quality impacts can be related to specific criteria in the standards, it is important that forest land uses and activities be conducted so as to not violate the state's antidegradation policy. Under EPA's Policies and Procedures for Continuing Planning Process (40 CFR 130), the

antidegradation policy must at a minimum provide for the maintenance and protection of existing instream water uses, and further degradation which would interfere with those uses is not allowable. In addition, "no degradation shall be allowed in high quality waters which constitute an outstanding national resource, such as waters of National and State parks and wildlife refuges and waters of exceptional recreational or ecological significance."

Clearly waters with high quality and special significance are to be afforded protection from degradation. The reviewer's assessment of impacts should involve judgments of the following:

.. Does the EIS satisfactorily identify stream segments and their classification, recreational and ecological significance and use?

.. Will special provisions be made to minimize pollution-causing activities near streams and in watersheds that have high quality and support valuable uses?

.. If activities in such areas are proposed, does the EIS fully describe the prevention and reduction practices to be applied, and will they be sufficient to prevent injury to instream water uses?

If the information provided for these points is insufficient to assess potential impacts, the reviewer should request further data and discussion of pollution control approaches. Particularly for headwaters areas the analysis should be based on maintenance of the overall ecological integrity of the area, and its ability to maintain existing populations dependent on existing water quantity and quality.

The Water Quality Management and River Basin Plans prepared under Section 208 and 303(e) contain assessments of nonpoint sources of pollution, including silvicultural sources where applicable and an identification and evaluation of measures necessary to achieve nonpoint source water pollution control. Under EPA's Regulations on Preparation of Water Quality Management Plans (40 CFR 131) the controls, regulatory programs, and management agencies are to be identified for each nonpoint source category.

Actions proposed by the Forest Service are subject to best management practice (BMP) criteria and other requirements of EPA-approved water quality management programs. EPA's nonpoint source control guidance documents and the information in Section III.A.2 of these guidelines generally identify prevention and reduction practices. The state regulations will normally be more specific and perhaps differ from area to area depending on the extent of water quality problems. The reviewer should compare the prevention and reduction practices addressed in the EIS with the applicable BMP requirements for the planning area to ensure that activities will be carried out without unacceptable water quality impacts. If information for making this comparison is lacking or certain activities would conflict with state regulations, the concerns should be raised in the reviewer's comments. The regional and state-wide water quality management coordinators may have been involved in the development and review of state nonpoint source programs and therefore able to assist the reviewer.

The environmental impacts of alternative courses of action should be carefully reviewed. Under the CEQ's new NEPA regulations (40 CFR Parts 1500-1508), effective July 29, 1979, and adopted July 30, 1979 by the USFS/USDA, impacts of the alternatives should be presented in comparative form to provide a clear basis for choice among the options. Alternatives other than those preferred by the Forest Service may have different water quality consequences and perhaps less impact. In areas of outstanding water resource value and other locations where water quality is critically important, the reviewer should ensure that activities will be conducted in the most environmentally beneficial way consistent with management and other objectives. The reviewer's assessment should include consideration of alternatives in four general categories:

.. Do nothing - Some activities, no matter how carefully managed, may pose risks of water quality degradation that are unacceptable in certain areas. For example, clearcutting or road-building on unstable slopes draining to a stream with a valuable fishery might have to be totally avoided due to major problems of preventing stream sedimentation.

.. Do, but at a different location - Recreational facilities or other developments can be located at alternative sites to reduce potential water quality impacts in sensitive areas.

.. Do, but in a different manner - Alternative choices may exist for harvest methods (selection instead of clearcutting), logging methods (various cable techniques, tractor, etc.), and other management activities, which afford substantially greater protection for water quality.

.. Do, but at a different time - The scheduling of almost all land-disturbing or other pollution-causing activities can be adjusted to avoid impacts at times when the ecology or use of a stream is highly susceptible to damage from sediments and other pollutants.

In cases involving water resources with high quality and value likely to be adversely affected by a preferred alternative, it is important that other less harmful actions be supported in the EPA review. The discussion of location, scheduling and nature of activities and pollution reduction practices in Section III.A.2 should help in understanding the range of alternatives available for various activities as well as the probably magnitude of impacts.

III.B. Review of Solid Waste Management Impacts

Solid waste often has only minor importance with regard to Forest Service land management. However, proper management of solid wastes is essential in national forests because of their intrinsic natural, aesthetic and recreational values. EPA's review should insure that acceptable solid waste management practices will be used.

III.B.1 Sources of Impacts

Human activity is the basic source of solid waste impacts. In national forests two types of solid wastes need to be considered: (1) refuse, garbage, trash and other foreign material brought by recreationists, workers and other visitors to the forest, and (2) native material such as logging debris and slash, generated as a result of logging, clearing, road construction, mining or other human activities. Although the latter originates from the forest itself, it still may cause problems and necessitate specific management practices to minimize adverse impacts.

Campgrounds, picnic areas, swimming areas, ski areas, hiking and snowmobiling trails and other recreational facilities are the principal locations of solid waste generation in national forests. All of these areas may attract large numbers of visitors. Solid waste generation may be localized and concentrated in relatively small areas as at picnic grounds, or widely dispersed along trails and virtually any other areas traveled by humans. The Forest Service has little direct control over the solid waste management disposal practices of individuals outside of established recreational areas, except through routine policing of trails and the general forest. Impacts from improper solid waste disposal are likely to be largely aesthetic, as the concentration of wastes would not generally be sufficient to create significant water pollution problems.

At more intensively developed and utilized recreational sites, solid waste management needs are greater and regular collection and disposal are necessary to minimize the potential for adverse impacts. In addition to litter, impacts could include attraction of flies and rodents if refuse is not properly contained and effects on surface or ground-water quality at disposal sites.

Materials such as slash, bark and other woody and herbaceous debris generated from various silvicultural activities, collectively termed residue, constitute a quite different solid waste problem. Quantities of forest residue may be substantial although largely non polluting, except when oxygen-demanding organic debris is introduced to water courses. Also, burning of the material may impact on air quality.

III.B.2 Review of Information Adequacy and Impact Quantification

In existing developed recreational areas adequate solid waste management practices are probably already being employed. In the case of new development proposed in the land management plan, solid waste storage, collection and disposal needs should be described. Projected visitation, waste quantities and landfill space requirements should also be addressed in the EIS. Guidance for estimating waste generation rates is contained in Design Criteria for Solid Waste Management in Recreational Areas (Little, 1972). Also, similar guidance is available in Solid Waste Management in Recreational Forest Areas (Spooner, 1971), a report prepared with specific applicability to national forests.

Regular collection of solid wastes is necessary to avoid adverse impacts. Frequency of collection is dependent on the numbers of visitors and the density of refuse containers in recreational areas. Collection at least twice weekly is highly desirable. Collection practices for existing recreational management areas as well as those proposed for new developments should be described in the EIS. It is important that sufficient numbers of containers are used to avoid overfilling between pick-ups. The reviewer should be able to judge the reasonableness of proposed refuse storage and collection by reference to waste generation rates and other information in the reports mentioned in the previous paragraph.

The sanitary landfill is the most common method of disposal of solid wastes. Disposal of wastes generated at a national forest could be accomplished at a landfill operated by the Forest Service, a private contractor or a municipality and located either on or off federal land. For new landfills, the EIS should contain information on the sites considered, including proximity to surface waters and to developed areas, topography, water table depth, soils, waste quantities to be disposed, availability of suitable cover material and proposed operating characteristics. The reviewer should object to sites posing a threat of pollution due to susceptibility to flooding, high ground-water levels, closeness to streams or other factors. While a landfill is in use, impacts are dependent principally on the mode of operation. The EIS should provide assurances that accepted practices will be followed to minimize impacts, including daily covering of refuse, proper grading, prevention of open burning and vector control.

The major impacts potentially associated with forest residues are water pollution and, if burning is involved, air pollution. Water pollution may be caused by organic debris introduced to water courses. Also, rearranging, mechanically treating or removal of residues may cause erosion and sedimentation due to disturbance and exposure of soil by equipment. Such impacts cannot be evaluated quantitatively; however, potential effects are in general related to the kinds of residue management practices employed and the extent of site disturbances associated with the practices. In cases where no special residue treatment is anticipated, measures still must be taken to minimize entry of logging debris to water courses and to remove material which does accumulate. Windrowing, piling, or mechanically treating forest residues may affect water quality through erosion of disturbed sites, with potential impacts dependent on the areal extent, severity, and location of the disturbances. Steep slopes and areas near streams are often more vulnerable to erosion than other locations.

III.B.3. Assessment of Solid Waste Impacts

Basically, solid waste management practices on national forests should be in compliance with applicable state and local regulations, EPA Guidelines for the Thermal Processing and Land Disposal of Solid Wastes (40 CFR, Parts 240, 241) and EPA Guidelines for Solid Waste Storage and Collection (40 CFR Part 243). These guidelines explicitly exclude solid wastes generated as a result of

mining and agricultural (including silvicultural) activities, and thus are relevant to wastes from campgrounds, recreational areas and other Federal installations on national forest lands.

The land disposal guidelines are mandatory for Federal agencies and delineate minimum levels of performance required of any solid waste land disposal site operation. Similarly, the solid waste storage and collection guidelines also apply to Federal agencies generating solid waste. The guidelines set forth required and recommended procedures for waste storage and collection. The EIS should indicate the nature of existing and proposed storage, collection and disposal practices and discuss how the requirements of the EPA guidelines will be met. Little's Design Criteria for Solid Waste Management in Recreational Areas may be referred to for more detailed guidance. If the information presented is insufficient to permit an evaluation of compliance with the guidelines, the reviewer should request additional discussion and documentation.

EPA's solid waste management guidelines do not apply to forest residues, and assessment criteria are therefore imprecise. The reviewer should expect an accounting of the land areas involved and methods that will be used to deal with debris from logging, thinning and other forestry operations. It is particularly important that measures to avoid debris accumulations in and near surface waters and to reduce erosion hazards are identified. If burning is required, it must be carried out in conformance with pertinent Federal and state air quality regulations (see Section III.C following). Adequate specifications of contractor responsibility and frequent field inspection of all work are necessary to reduce environmental impacts from residue management, and should be provided for in the plan implementation.

III.C. Review of Air Impacts

Although air pollution does result from various forest land management activities, impacts are likely to be minor in most cases. Nevertheless, it is important that the reviewer be aware of the kinds of impacts which could occur and ensure that they are considered in the EIS.

III.C.1. Sources of Impacts

Potential sources of air pollution can be readily identified; their occurrence depends on the nature of planned land management activitites in a national forest area. Air impacts may be associated with the following:

- Exhausts from motorized equipment and vehicles, including tractors, skidders, logging trucks, automobiles and off-road recreational vehicles.
- Dust generated by equipment movement and use.
- Incineration of solid wastes from recreational or other areas.

.. Burning of slash, brush, and other forest debris.

.. Uncontrolled forest fires

Pollutants from vehicles and equipment include unburned fuel vapors, hydrocarbons, carbon monoxide, nitrogen oxide, sulfur oxides and particulates. Vehicular emissions in national forests are unlikely to result in measurable impacts on air quality, however, due to the small numbers of vehicles and their widely scattered usage. At work sites, exhausts and dust may cause very localized problems.

Combustion products from open burning are primarily smoke, carbon monoxide, and unburned distillation and pyrolysis products. The amounts of emissions depend on the type of fuel, stage of burning (start-up, full-fire, or die-down) and the size of fire. For example, area or broadcast burning with low fuel concentrations will likely result in less complete combustion and emission of more potential pollutants than piling and burning. And larger piles of forest residue will burn hotter and more completely than smaller piles.

Particulate matter and also sulfur dioxide and nitrogen oxides contribute to lowering visibility, discoloring the atmosphere, and producing haze. The 1977 Amendments to the Clean Air Act contain requirements to protect visibility in Class I areas, which include many of the national forests. EPA has published a final rule (40 CFR Part 81, effective November 21, 1979) identifying mandatory Class I Federal areas where visibility is an important value.

III.C.2. Review of Information Adequacy and Impact Quantification

Predictive methods of the sort used in evaluating air quality impacts of highways and motor vehicle emissions would not generally be applicable to national forest situations, where vehicle usage is unconcentrated and irregular both spatially and temporally. Impacts are unlikely to be significant in any case and no special quantitative analysis is required. Automobile and other vehicle emission standards would indirectly serve as a control on some air pollutants.

Burning of slash and other forest debris is an important management practice in many national forests. Burning is used for several purposes including disposal of residue, reduction in fuel accumulations to reduce forest fire hazard, preparation of sites for forest regeneration and removal of competing vegetation underneath established stands.

Air quality impacts attributable to burning of forest residues are not generally predictable in a quantitative sense, although qualitative inferences are possible based on relationships among fire behavior, fuel characteristics and meteorological conditions, topography and other environmental variables. The use of fire should be "prescribed" in order to minimize potential air pollution while accomplishing a desired management objective.

In prescribed burning critical factors that must be planned are timing of the burn to correspond with favorable weather and atmospheric conditions, and controls to confine and regulate the intensity of the fire. Careful planning and administration of burning programs should minimize both the production of smoke and other air pollutants and the transport of pollutants to sensitive areas, particularly Class I areas designated under PSD (Prevention of Significant Deterioration). Proposed methods of conducting and controlling forestry uses of fire should be clearly delineated in the management plan and EIS.

Some general guidelines to help the reviewer evaluate characteristics of burning programs include the following (Cramer, 1974):

.. The more concentrated the fuel the more complete will be the combustion. Thus, piling and burning of slash may produce lower emissions than area burning of an equivalent amount of fuel.

.. Greater emissions are produced during the start-up and die-down stages than during the full-fire stage. Higher concentrations of fuel will reduce the start-up and die-down stages, particularly if fuel is added to a full fire to maintain high combustion temperatures.

.. In area burning, a "backing" fire (that is, against the wind) is likely to be more efficient than a more rapidly moving head fire.

.. Any controlled burn is apt to be more efficient and produce lower emissions than an uncontrolled wildfire.

.. The damper the fuel, the less efficient is combustion and the denser the smoke produced. Thus, slash and debris to be burned should be as dry as possible.

Uncontrolled wildfires may contribute significantly to air pollution, although the effects are unpredictable as to time, location or magnitude. Nevertheless, forest fires could be cause to prohibit controlled or prescribed burning in an area, at least temporarily until air quality returned to more normal levels. In order to carry out burning in such a way as to minimize air impacts, predictions are necessary of wind speeds and directions, mixing layer characteristics, stability and other meteorologic factors as well as the prevailing air quality conditions. Of course, such predictions must be made just before burning; however, the EIS should describe the criteria that would be applied to determine how and when burning would be done.

III.C.3 Assessment of Air Impacts

The reviewer's assessment of air impacts should focus mainly on prescribed burning plans, if any are involved. Vehicular emissions are likely to arise

from a relatively small number of widely dispersed sources and not cause identifiable problems. Reduction of dust resulting from logging, truck traffic, and other equipment operations should be required as part of contract specifications.

Forestry uses of fire can be managed to control air emissions within acceptable limits if proper precautions are taken. In assessing potential impacts and adequacy of the EIS, the reviewer should ensure that:

.. Burning programs will be fully coordinated with the state air pollution control agency.

.. Alternatives to burning have been explored and described, their impacts identified and reasons stated for not selecting such options.

.. Conditions under which burning will or will not be allowed are identified in the EIS in conformance with ambient air standards (especially for particulates).

Some states, and the Forest Service itself in some regions, have smoke management plans or systems in which location, extent, timing, meteorological conditions and other factors influencing particulate production and transport may be prescribed to minimize potential air pollution. Other more general regulations may apply to open burning. The EIS should address these requirements as well as management plans to comply with the requirements. If this information is lacking, the reviewer should request additional descriptions of planned management approaches. It is essential that controls be sufficient to allow termination of burning in the event of adverse changes in wind or other conditions.

Under the 1977 Amendments to the Clean Air Act, large Wilderness Areas (in excess of 5,000 acres) are designated as Class I areas, in which very little deterioration of air quality is allowed. Other national forest areas where the existing air quality is better than the national ambient air quality standards may also be designated as Class I, or Class II or III areas. EPA has identified mandatory Class I areas where visibility is an important value (CFR Part 81). The Forest Service has also issued a list of 15 National Forest primitive areas recommended for redesignation as Class I (44 F.R. 24116, April 24, 1979).

The reviewer should be familiar with EPA's regulations pertaining to prevention of significant deterioration of air quality (40 CFR 51.24) which specify maximum allowable increases for particulate matter and sulfur dioxide in such clean air areas. These requirements could necessitate special controls on slash burning to prevent violation of particulate standards. The EIS should indicate the class designations of planning areas, particularly where burning is proposed, and demonstrate that burning will be carried out in conformance with the applicable standards. The 24-hour maximum allowable increases over the baseline for particulate matter (40 CFR 51.24) are:

Class I	10 micrograms per cubic meter
Class II	37 micrograms per cubic meter
Class III	75 micrograms per cubic meter

The reviewer should ascertain whether the Forest Service has made a determination that the plan does or does not conform with the requirements of an EPA-approved State Implementation Plan. A few of the national forests are located in nonattainment areas where national ambient air quality standards are not being met although most are in areas subject to PSD. Either the state's regulations for preventing the significant deterioration of air quality or EPA's requirements in 40 CFR Part 52.21 if the state plan for PSD has not been approved, are applicable in areas where air is cleaner than the standards.

EPA is currently in the process of drafting regulations for protection of visibility in Class I areas (see Advance Notice of Proposed Rulemaking, November 30, 1979 Federal Register, p. 69116). When promulgated, these regulations will specify requirements to be met in regard to Class I areas.

III.D. Review of Noise Impacts

Noise is not generally of critical concern in national forests, except to the extent that it may be annoying to recreational and other users of the Federal lands. This section briefly discusses aspects of noise which should be addressed in the forest plan and EIS.

III.D.1. Sources of Impacts

Noise sources of possible concern are predominantly motor vehicles and machines, including skidders, tractors, trucks, chain saws, motorcycles, snowmobiles, automobiles and others. Although the potential for adverse health effects is minimal, noise may be important in national forests simply due to its being "out of place" in the natural environment and likely disturbing to recreational visitors.

III.D.2 Review of Information Adequacy and Impact Quantification

The impacts of noise in national forests are not amenable to quantification or prediction, since reactions to noise are apt to be very subjective and different for different individuals. Problems can be reduced by providing for geographic separation of certain potentially incompatible uses. Not only the distance but also the nature of the separation are important; for instance, noise levels will be attenuated more rapidly in forested areas than on open land, and noise may carry long distances over open water. Topography also influences sound travel.

III.D.3. Assessment of Impacts

In general assessment of noise impacts will be qualitative without reference to specific standards for noise levels. The principal issue is the compatibility of noise-producing activities with other recreational uses of the forest. Conflicts are most apt to arise between recreational vehicle users and persons visiting the forest for hiking, nature study, photography, snowshoeing and similar pursuits. It is important that ways of minimizing these conflicts are recognized and planned for. One approach is to provide for geographic separation of uses, for example, prohibiting use of recreational vehicles on or near hiking trails. Motorized vehicles are presently not allowed to operate on designated wilderness areas. Time restrictions, such as banning use of snowmobiles or motorbikes after sunset, could also lessen noise disturbances. Recreational land use plans should be designed to reduce, to the extent possible, noise problems and impacts caused by off-road vehicles.

III.E. Review of Pesticide Impacts

Pesticide usage in national forests is generally not addressed in detail in Forest Service land management plans. Rather, separate EISs are required for operational programs involving use of pesticides. The reviewer should, however, have a basic understanding of the nature and potential impacts of pesticides used in silviculture. The following sections should provide a brief orientation to silvicultural uses of pesticides and potential impacts.

III.E.1. Sources of Impacts

Pesticides used in forestry fall into two major groups; (1) herbicides, which are used to control various undesirable trees, shrubs and other plants; and (2) insecticides and rodenticides, applied to control insect and animal pests and thereby protect commercially desirable tree species. Although pesticides are important in both forestry and agriculture, the patterns of use differ considerably. Most forest lands are never treated with pesticides and those that are rarely receive more than one treatment over a cutting cycle of several decades. Also, only a relatively few pesticides (fewer than 10 principal ones) are used in silvicultural applications as opposed to the larger numbers for agricultural purposes. Forestry accounts for slightly more than 1 percent of total pesticide use in the U.S. (Forest Service, 1977). These facts are not meant to minimize potential problems with silvicultural use of pesticides, but rather to indicate the relative scope of such uses.

When applied at registered rates, herbicides directly affect only green plants, although animals dependent on primary producers for food and cover may be indirectly-impacted. In general forest use herbicides are normally applied by aircraft. Broad treatments are generally required only once or twice in an area which is being brought under management. Ground application of herbicides is practiced for more selective treatment of smaller areas.

Ground application methods can be carried out with negligible effects on water quality. The greatest concern with aerially applied herbicides is the potential

for introducing the chemicals to watercourses. Avoidance of spraying along creeks and streams and near populated areas is the principal pollution control technique for aerial herbicide application.

EPA temporarily banned the use of the herbicides 2, 4, 5-T and Silvex on forests, pastures, and powerline rights of way in March 1979 after a study showed a significantly high rate of miscarriages in the town of Alsea, Oregon shortly after nearby forest areas had been sprayed with 2, 4, 5-T. This pesticide is currently being reviewed under the EPA's RPAR (Rebuttable Presumption Against Registration) process. 2, 4, 5-T is an important silvicultural tool used to suppress hardwoods and clear weed species from intolerant softwood stands. The reviewer should be aware of the status of restrictions on herbicide and other pesticide usage, which may change through EPA action as a result of studies of health hazards or other impacts of particular chemicals.

Insecticides are mainly used to control widespread epidemics of defoliating insects that affect commercially valuable timber. Insecticide applications often involve large infested areas, since partial treatment could allow further spreading of insect populations and damage to timber. Insecticides and rodenticides used on the ground are applied in very small quantities and usually away from open water. Few if any incidents of stream ecosystem damage from ground application of insecticides and rodenticides have been reported in the literature. With proper use of the chemicals and barring accidental spills, water quality effects are likely to be undetectable.

The reviewer should refer to Silvicultural Chemicals and Protection of Water Quality (Oregon State University, 1977) for a listing of silvicultural pesticides and descriptions of the nature and extent of their use. No matter what pesticide is used, the greatest water quality threat is posed by direct applications to watercourses during aerial spraying. Also, insecticides are potentially more hazardous than herbicides due to their toxicity to animals and, in some cases, their tendency to bioaccumulate in the food chain. Because runoff from forest lands is slight and pesticides are very rapidly absorbed and bound up in forest soils, the risk of pesticide pollution from treated areas not adjacent to streams or lakes is usually quite low.

III.E.2. Review of Information Adequacy and Impact Quantification

It is important that all proposed pesticide uses for a planning area are identified and described in the land management plan and accompanying EIS. If operational programs involving pesticides are addressed in a separate EIS, the document should be incorporated by reference and the proposed programs described.

Also, the EIS should delineate, for pesticide uses not covered in a programmatic EIS, the areas that would be treated, the chemicals that would be used and the methods that would be used to minimize chemical drift to nontarget areas, safeguard against accidental spills and monitor operations and water quality. Table 6 in Silvicultural Chemicals and Protection of Water Quality gives recommended rules on the size and treatment of buffer strips based on the potential hazards of several forest chemicals and for monitoring of water quality. The text

provides more detailed guidance on these topics and should aid the reviewer in evaluating the adequacy of planned control measures.

III.E.3 Assessment of Pesticide Impacts

Because of the toxicity and other potential hazards associated with pesticides, their use is carefully planned, regulated and monitored, particularly when treatment of large areas is called for. The EIS should demonstrate that applicable federal and state laws and regulations concerning pesticides will be adhered to, and that all reasonable means of preventing and minimizing adverse impacts will be employed. The basis for federal involvement is the Federal Insecticide, Fungicide, and Rodenticide Act as amended by the Federal Environment Pesticide Control Act of 1972 and accompanying EPA regulations. All pesticides to be used in silviculture must be registered for that use, applied by certified pesticide applicators and used in strict conformance with registered application rates.

In addition, the reviewer should ensure that special precautions will be taken in the vicinity of streams and other water bodies to minimize the possibility of introducing pesticides directly to open water. Aerial applications of pesticides should be carried out when weather conditions are favorable for minimizing drift and assuring that a maximum amount reaches target species. Proper handling and disposal of all pesticide containers and residues are also essential in minimizing pollution. Waters used for drinking water supply or irrigation, in particular, require a high degree of protection from contamination by pesticides.

In some cases reasonable alternatives to the use of chemical pesticides may exist and should be considered. For large-scale insect infestations, there may be no choice but to use pesticides, although considerable research is underway into biological control methods for specific insect pests. Options may be available in pesticide selection, however, to accomplish the desired objective. That is, one suitable type of pesticide may have lower persistence and toxicity or higher selectivity for target species, and thus pose less environmental risk in its use than another. Such choices should be fully evaluated in the EIS.

Possible alternatives to herbicides may include fire (light broadcast burning, for example) and removal of competing vegetation either by machine or by hand. These options and their environmental consequences should be discussed and compated in the EIS along with the no-action alternative.

Recommended maximum concentration levels for silvicultural chemicals, including allowances for variation in stream size and use, are presented in Silvicultural Chemicals and Protection of Water Quality. This report expands somewhat on information in EPA's Quality Criteria for Water and should be used as a guide for assessing impacts of pesticides used in national forests.

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