Chapter IV
Environmental Consequences

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Chapter IV presents the environmental effects if either the preferred or another alternative is implemented as the Forest Plan.

Major Changes to Chapter IV

A number of changes were made to the Draft Environmental Impact Statement. Parts C and D of Chapter IV have been changed to reflect revisions made to alternative 7 in response to public comments. Tables and discussions in both these parts now reflect the outputs, practices, and effects of revised alternative 7.

These changes and all those made throughout this document are due to the review of the draft documents by both the public and the Forest Service. The changes which are found in the Final Environmental Impact Statement are the result of attempts to make this document as responsive to the public as was possible.

Overview

This chapter presents the environmental effects if either the preferred alternative or another alternative is implemented as the Forest Plan. The effects discussed in this chapter include outputs and inputs, as well as positive and negative environmental effects. Information in this chapter is pertinent to the net public benefit equation:

Outputs and positive effects (benefits)	minus	Inputs and negative effects (costs)	equals	Net public benefits

The effects form the basis for the comparisons made in Chapter II. The effects can also be viewed as changes in the present environmental conditions described in Chapter III.

This chapter describes the environmental effects, cumulative effects, the relationship between short-term uses of the human environment and long-term productivity, irreversible and irretrievable effects, and adverse effects that cannot be avoided. The means to mitigate adverse effects and monitoring requirements are also discussed.

The planning period being considered for the FEIS is 10 to 15 years. Throughout this document, projections beyond 10 to 15 years are listed for the purpose of showing effects. The decades beyond the first decade represent the projected situation if the alternatives were fully implemented for that time period.

In some instances, figures are presented as an average annual amount over the first two decades combined. In these cases, figures for individual decades are displayed in the Appendix Volume, Appendix B, Chapter VIII.

Information that can aid in understanding the environmental effects are found in a number of places in this Final EIS and Forest Plan:

- Management problems	Chapter I, Final EIS
- Present environmental conditions	Chapter III, Final EIS
- Alternative descriptions	Chapter II, Final EIS
- Selection of management areas	Chapter II, Final EIS
- Management area location	Enclosed Maps in Map Packet
- Management area standards and guidelines	Chapter IV, Forest Plan
- Kinds of costs and benefits	Chapter II, Final EIS
- Roadless area evaluation	Final EIS Appendix Volume, Appendix C
- Research natural area evaluation	Final EIS Appendix Volume Appendix E

- Recreation opportunity spectrum explanation	Forest Plan Appendix, Appendix F
- Viable population of vertebrate species	Final EIS Appendix Volume, Appendix F
- Ecological classification system description	Forest Plan Appendix, Appendix D
- Harvest cutting methods	Forest Plan Appendix, Appendix C
- Endangered, threatened, and sensitive species	Final EIS Appendix Volume, Appendix H
- Management Indicator Species	Final EIS Appendix Volume, Appendix I

Using the above information and the information presented in this chapter, readers should be better able to compare the alternatives and decide which alternative they prefer.

PART A. CAUSES OF ENVIRONMENTAL EFFECTS

Environmental effects are caused by management practices. A management practice is a set of activities that alters the character of the landscape and affects the forest environment.

The environmental effects of an alternative result from applying various management practices to management areas in order to provide public benefits. The effects of the practices can be either quantitative or qualitative. Quantitative effects might be measured in acres or miles or roads, while qualitative effects are measured subjectively. Many qualitative effects, such as on visual quality, are nonpriced outputs, which can only be measured through public opinion, not by dollars. The positive and negative effects of changes in visual quality can only be measured by the importance the reader attaches to the visual resources.

Some management practices will not have significant effects on the environment. For example, significant effects result from road construction; the subsequent maintenance is insignificant. The reader can compare the practices discussed in this section against those listed in the management area prescriptions (Chapter IV of the Forest Plan) and identify a complete list of practices that are not significant in terms of the environment at this level of planning. Some of these practices may be significant at the project planning level, but they are not relevant to the Forest Plan decision.

The practices listed in Table 4.1 were identified by the Forest land management planning interdisciplinary team as potentially causing significant environmental effects. An individual practice may respond to several problems, but each practice is discussed only once. The chart shows the relationship of the practices to the management problem and indicates which problem the environmental effects of the practice are discussed under.

Table 4.1
Relationship of Practices to Management Problem

Practices	Problems		
	Transportation 1	Wildlife and Vegetation 2 and 4	Wilderness 5
Local road reconstruction and construction	A	B	B
Harvest-clearcut	B	A	B
Harvest-thinning	B	A	B
Harvest-selection	B	A	B
Harvest-shelterwood	B	A	B
Reforestation-artificial	B	A	B
Reforestation-natural	B	A	B
Release	B	A	B
Precommercial thinning	B	A	B
Wilderness designation	B	B	A

Legend

A = Environmental effects of this practice are discussed under this problem.

B = Other pertinent environmental effects of this practice are discussed under this problem. Most of the discussion of the effects is under (A).

PART B. AFFECTED ELEMENTS OF THE ENVIRONMENT

Interdisciplinary review of the issues, concerns, management problems, and existing environmental conditions identified which elements of the environment would be affected by the practices listed above in Table 4.1. The existing conditions of the environment are described in Chapter III of this document by element in the same order as discussed here.

The interdisciplinary team further evaluated whether effects of a practice on an environmental element would be (1) significant, (2) mitigated by standards and guidelines such that any effects are insignificant, or (3) insignificant or nonexistent. This was done considering the effects of a practice/program from a Forestwide perspective only.

Table 4.2 summarizes the results of this analysis. This table lists the management practices under the relevant problem statements. The environmental elements affected by these practices are shown across the top of the table. Within the table, the level of effect is indicated by the following:

Symbol	Level of Effect
S	When applied to National Forest land, this practice could cause significant change in the quality or quantity of this environmental condition. The change could occur directly or indirectly as a result of the practice.
M	Forest Plan standards and guidelines should mitigate effects of this practice. Management area prescriptions and associated standards and guidelines are located in Chapter IV of the Forest Plan.
S/M	Some effects of the practice are significant and others are mitigated.
0	This practice would not cause significant change to the existing conditions.

Table 4.2
Environmental Elements Affected by Management Practices

Environmental Elements	Local Road Construction	Harvest - Clearcut	Harvest - Thinning	Harvest - Selection	Harvest - Shelterwood	Reforestation - Artificial	Reforestation - Natural	Release	Precommercial Thinning	Wilderness Designation
	Management Practices									
Soil Productivity	S	M	M	M	M	M	M	M	O	O
Minerals	S	O	O	O	O	O	O	O	O	S
Visual	S	S/M	M	M	S/M	M	M	M	O	O
Cultural	M	M	M	M	M	M	M	M	M	O
Fire	O	M	M	M	M	M	M	O	O	O
Riparian Areas	M	M	M	M	M	M	M	M	O	O
Water Quality	M	M	M	M	M	M	M	M	O	O
Air Quality	O	O	O	O	O	O	O	O	O	O
Noise	M	M	M	M	M	M	O	M	M	O
Wild/Scenic Inventory Rivers	O	O	O	O	O	O	O	O	O	O
Research Natural Areas	O	O	O	O	O	O	O	O	O	O
Roadless Areas 1/										
Roads	S	O	O	O	O	O	O	O	O	S
Vegetation	S	S	S	S	S	S	S	S	O	S
Timber Production 1/										
Wildlife	S	S	M	S	S	S	S	M	M	S
Fish	M	M	O	O	O	O	M	O	O	M
Endangered, threatened, and sensitive species	S/M	M	M	M	M	M	M	M	M	O
Range	O	O	O	O	O	O	O	O	O	O
Recreation	S/M	M	M	M	M	M	M	M	M	S
Economic 1/										
Social 1/										

1/ These elements are discussed in Part D of this chapter - Cumulative Effects

Significant effects of management practices are discussed in Parts C and D of this chapter.

Part C, Environmental Effects of Practices, shows how individual practices listed under each management problem could have a significant effect on an environmental element. The practices and their potentially significant effects on certain environmental elements are described in Part C and are designated with the symbol "S" in Table 4.2.

Part D, Cumulative Effects of Alternatives, describes the cumulative effects of an alternative which is the result of the application of all management practices needed to provide the outputs and benefits of that alternative. The cumulative effects of the management practices on the environmental elements is described element by element and comparisons are made between alternatives. Again, the management practices described for each element are those designated with the symbol "S" in Table 4.2.

Part H, Means to Mitigate Adverse Effects, contains a discussion of effects on environmental elements that do not change by alternative, can be mitigated, and/or do not significantly change the existing condition as described in Chapter III of this document.

PART C. ENVIRONMENTAL EFFECTS OF MANAGEMENT PRACTICES

This section describes the environmental effects caused by implementing the significant management practices. The only effects discussed are those designated "S" under the management practices in Table 4.2.

This discussion is organized by management problem in order to show the effects that will result from addressing them. Under each problem, the following is discussed:

- The effects of practices that will cause significant change in the quality or quantity of the existing environmental elements as identified in Table 4.2.
- A comparison of effects by alternatives or groups of alternatives.

Problem - 1 Transportation

The transportation management problem involves deciding what form of transportation network is needed to provide access for a variety of recreational opportunities and to provide access and transportation of timber products to market in a timely manner.

Part of the problem is one of efficiently matching season of access and the amounts of forest resources that different road standards can make available, considering the costs of construction and the impact that a road or its operation and use can have on desired recreational settings.

Essentially, the collector and arterial road system is in place. The remaining roads on the Forest are local roads.

The presence of existing roads is generally not a controversy, nor is reconstruction of existing low standard roads on the Forest. However, the need for construction of additional roads is. Some citizens feel additional access to the Forest is needed; others feel existing roads should suffice. Some local residents and Forest visitors value the remote character of the landscape, which could be threatened by intensive road construction.

What constitutes the best road for the purpose is a source of disagreement. Some loggers and off-road-vehicle users view the roads now constructed for timber operations as excessively high standard and a waste of public money. Other loggers feel the same roads are too low a standard for modern equipment.

Some areas of the Forest have a high density of roads while others have a relatively low density. Areas with a high road density permit easier access to locations within them and the resource uses they have. High density areas are generally more efficient for timber harvesting operations and can accommodate many recreation users over a period of time. These areas, in general, lend themselves to a roaded natural recreation setting.

They can, if intensively managed, produce a high yield of timber fairly efficiently. And as a result of harvesting operations, these areas can achieve vegetation conditions favorable to wildlife game species as well as many other nongame species.

The density of roads and the mix of road standards that compose the transportation system on the Forest will vary from one management area to another. The Forest has the opportunity to manage some areas with reduced road densities and standards to provide for semiprimitive motorized or nonmotorized Recreation Opportunity Spectrum (ROS) settings. Other areas could be managed with higher densities and standards of road to allow for more efficient transportation of timber products, while providing a roaded natural ROS setting.

Responding to the problems facing the Forest will require balancing high density road areas and their relatively high potential yield of many resource uses with lower density areas which can produce resource products at a slower rate but also supply recreation and wildlife uses not available in high density areas.

Part of the response to the transportation problem must strive to reach a balance between competing uses dependent or influenced by the road system itself.

Management Practice: Local Road Construction

This practice includes transportation system planning and inventory, local road preconstruction, construction, maintenance, road closures, and other associated road management activities necessary for resource management. The roads will be part of the Forest transportation system.

Local roads are constructed by the Forest Service. Before new roads are constructed, area-specific transportation planning is accomplished through the integrated resource management process to determine the location, lengths, and standards of roads needed for resource management. Limits on the standards of roads and road density are stated in the management prescriptions.

Local roads provide access to National Forest System lands. The vast majority are single lane, dead-end roads that terminate on National Forest System land. Generally, local roads are single-lane roads, some have turnouts.

In management area 6.1, local roads will be closed to passenger vehicle and ORV use except existing ORV trails such as long established groomed snowmobile trails until they are relocated or roads to provide access to private property. In management area 6.2, local roads will be closed to passenger vehicle use and some will be closed to ORV use.

Table 4.3 displays the current level and average miles of local road construction that will take place per year for the first 2 decades by alternative.

Table 4.3
Average Annual Miles of Local Road Construction per Year Over the First 2 Decades

	Alternatives							
	1	2	3	4	5	6	7	8
	(average annual miles per year)							
Local road construction over 2 decades (current level = 41)	29	28	28	33	33	43	38	34

Local road construction in alternatives 1, 2, 3, 4, 5, 7, and 8 is lower than the current rate of construction. Only alternative 6 constructs local roads at a rate higher than the current level.

As shown in Table 4.4, most of the amount of local road construction will decline in the later decades since the local road system will be in place within the next four decades in all alternatives.

Table 4.4
Average Annual Miles of Local Road Construction for the Fourth and Fifth Decades

		Alternatives							
		1	2	3	4	5	6	7	8
		(average annual miles per year)							
Local road construction for fourth and fifth decades (current level = 41)	Decade 4	18	33	27	12	4	5	13	19
	Decade 5	11	8	6	8	0	7	5	5

In the long term (fourth and fifth decades), the amount of local road construction in all alternatives is lower than the current rate. By the fifth decade, local road construction will have decreased to 0 to 25 percent of the current level of local road construction.

Local road construction includes new construction on new road locations and construction on existing old road locations that were not included as "existing roads" in the planning/analysis data base. As a result, 60 to 90 percent of local road construction will be on existing "old road" locations.

Local road construction may significantly affect the soils, minerals, visual, roads, wildlife, endangered and threatened species, and recreation environmental conditions.

Effects of Local
Road Construction

Soil Productivity

Local road construction directly affects soil productivity by removing top soil, altering soil and soil moisture regimes, and causing soil compaction. Depending on the surfacing and road closure practices, this loss of productivity may be irretrievable on a short-term and/or long-term basis. Local road construction directly affects soil productivity of borrow areas from which road fill and gravel surfacing is removed. Exposed and disturbed soils will present a greater opportunity for erosion. However, this has not been a major problem on the Forest.

Minerals

Construction of some new local roads requires gravel for surfacing. Common variety minerals therefore will be irreversibly consumed in quantities proportional to the amount of road building and standard of road. Gravel is used primarily on higher standard roads to provide a longer season of use in loamy and clayey soils. Winter-only roads or roads constructed in sandy soils do not require gravel surfacing.

Presently, the most accessible and least costly gravel sources are being used on the Forest. As these sources are exhausted, new sources that are more expensive to develop will be used. Road surfacing costs will thereby increase.

Visual

Construction of roads can significantly modify the existing visual resources. Construction creates an obvious human-made corridor through the Forest and an opening in the forest canopy. The road increases the area of the Forest that can be viewed as foreground. The road contrasts with the surrounding landscape.

Road cuts, fills, and debris such as large rocks, excess soil material, stumps, trees, and other vegetative matter alter the existing naturally established characteristic landscape.

On the other hand, local roads increase the opportunity for forest users to penetrate areas of the Forest to view distinctive visual resources including fall colors and wildlife.

Roads

Local road construction can have an effect on the existing road and trails transportation system in any given area. Forest users will find it difficult or impossible to use areas because all or parts of a transportation system would be closed during and following local road construction. Roads are closed to protect the investment of the existing roadbed, drainage facilities and surface materials, particularly during spring breakup and other times when soil moisture is excessive.

Local road construction provides access to the Forest to remove and transport forest products. Also, road construction provides recreation users with opportunities to access areas of the Forest for hunting, fishing, gathering forest products such as firewood and other activities not previously accessible. No additional access would be provided in management areas 6.1, 8.1, 8.2, 8.3, 8.4, and 9.1 under any alternative.

Vegetation

Local road construction affects vegetation in two ways. A direct effect on vegetation occurs by converting a previously forested condition to a nonforested condition. The area occupied by roads is no longer vegetated with trees and, therefore, the total land that is producing benefits from the vegetation, such as timber, is reduced.

The second effect of road construction is the indirect effect of providing access to the vegetation for the management and use of the benefits that can be derived.

Without construction of local roads, many benefits induced by the management of vegetation would not be provided. These benefits include timber production, wildlife habitat improvement, and a variety of dispersed recreation activities.

The utilization of a range of benefits produced is affected by the construction of local roads. The overall mix of benefits produced in an alternative is in part dependent on the amount of local road construction planned.

Among the range of alternatives, the amount of forest land converted to nonforest will not cause significant impacts on the vegetation. The amount of land taken out of vegetative production does not limit the production of benefits to a level below demand for those benefits. The overall direct and indirect impacts on the vegetation is not significant at the levels needed in any of the alternatives.

Wildlife

Local road construction is likely to have an effect on wildlife species where an essential element of their habitat is a remote environment. New local roads have the potential to result in greater disturbance of wildlife as a result of increased public use.

The barred owl, bald eagle, osprey, goshawk, great blue heron, bittern, marten, black bear, and gray wolf usually do not mix well with people.

For other wildlife species, a well-roaded landscape is desirable for harvest of game species and other nonconsumptive recreation uses.

For example, roads provide access for hunters so that they can harvest surplus animals, including deer, ruffed grouse, and other game species. Animal populations are thereby kept in balance with available habitat. On the other hand, a high degree of accessibility can result in the overharvesting of some species, including the black bear, which could decrease production in succeeding years.

Roads provide access for integrated timber management and wildlife habitat management activities. These activities can increase wildlife habitat diversity and the production of both game and nongame species while at the same time providing timber products.

Endangered and Threatened Species

Local road construction can have a negative effect on the habitat required for the bald eagle, peregrine falcon, and gray wolf. The time of the year construction of the road occurs and the location of the road with respect to the bald eagle's nest is critical especially at nesting time.

The amount of local road construction, the standard, and whether the roads remain open for passenger vehicle use is critical for the gray wolf.

None of these endangered and threatened wildlife species can withstand continued disturbance and exposure to human activities.

Recreation

Local road construction affects recreation opportunities. Where access is increased and roads are open, motorized recreation will

increase, while nonmotorized recreation will decline. Where new local roads are constructed, roaded natural opportunities, such as fuelwood gathering and deer hunting, will increase while semiprimitive opportunities, such as hiking and backpacking, will decrease as a result of increasing the density of roads.

The standards and density of roads may also cause conflicts between motorized and nonmotorized recreation users. Road closures can mitigate such conflicts by limiting motorized use. Closing of roads, even on a seasonal basis, can provide for a range of recreation opportunities. Road closures can reduce localized noise levels with the elimination of motorized vehicles. Road closures can provide trails for hikers and hunters who prefer to walk as they pursue game and not be bothered by motorized vehicles. Finally, road closures can provide for nonmotorized recreation activities in areas that are currently managed for roaded natural settings.

The Ottawa National Forest has the potential to provide a range of recreation opportunities from semiprimitive nonmotorized to roaded natural Recreation Opportunity Spectrum (ROS) classes. Refer to Forest Plan Appendix F-Recreation Opportunity Spectrum Explanation for definitions of the ROS classes.

Management prescriptions are designed to provide different kinds of recreation environments suitable for different kinds of opportunities. Local roads have a definite effect on these environments. Refer to Forest Plan, Chapter IV for management prescriptions including kinds of ROS class being emphasized for each.

Refer to Chapter II, Table 2.11 for the amount of land in each management area by alternative and the alternative maps in the map packet for the location of each management area.

Problems 2 and 4 - Wildlife and Vegetation Management

A variety of resource benefits are provided in combination as a direct or indirect result of how forest vegetation is managed. Vegetation management involves manipulation of the forest vegetation by means of a sequence of management practices.

This sequence and combination of practices produces a mix of benefits such as timber products, wildlife habitat, vegetative diversity, and visual variety in the short term. Many of these vegetation management practices provide benefits for many years to come.

Management objectives establish the mix of resource benefits to be produced in both the short term and the long term. Benefits that are produced from management of the vegetation include a variety of timber products and a variety of vegetation conditions in terms of vegetative type composition and age class distribution. The vegetative composition along with the distribution of age classes are very important elements in providing a full spectrum of wildlife species.

Wildlife habitat and vegetative diversity (cover types and age classes) are improved primarily through vegetation management accomplished through commercial timber sales. Recreation and visual resource values are also increased through management of the vegetation in a manner that works toward and maintains desired vegetative conditions, while at the same time producing timber products.

Vegetation management practices and the location, design, and timing of them can be used to work toward more desirable vegetative conditions and provide opportunities to respond to the wildlife and vegetation management problem.

Some management practices, such as harvest-thinning, produce timber products and provide raw materials for the manufacture of lumber, veneer, plywood, particle board, paper, and other wood products.

Practices such as harvest-clearcutting and harvest-shelterwood result in temporary openings being created within the forest. These temporary openings provide desired habitat conditions for certain species of wildlife while displacing others. Clearcutting is also a source of public concern, due to the potentially adverse visual impacts.

The acreage of even-aged regeneration cutting (clearcutting and shelterwood seed cutting) provides a good indicator of the amount of temporary openings created. These temporary openings provide valuable habitat for some species of wildlife for 5 to 15 years following regeneration harvest.

Management practices that manipulate the vegetation include:
- Harvest-clearcut,
- Harvest-thinning,
- Harvest-selection,
- Harvest-shelterwood,
- Reforestation-artificial,
- Reforestation-natural,
- Release,
- Precommercial thinning.

On the following pages, each of these practices which are associated with the wildlife and vegetation management problems is described, including the amount of the practice planned by decade for each alternative and a discussion of the practice's significant environmental effects as shown in Table 4.2.

Management Practice: Harvest-Clearcut

Harvest-clearcut is a regeneration harvest method used in an even-aged silvicultural system.

With the exception of trees left for wildlife or visual purposes, all merchantable trees on an area are harvested at one time in clearcutting. Unmerchantable trees are often also felled to eliminate competition with the regeneration. Regeneration of tree species develops from natural seeding and/or sprouting or artificial seeding or planting in clearcut areas. This regeneration method favors the establishment and development of shade-intolerant species, such as aspen and jack pine.

Clearcutting is a method that can provide for the disturbance of a site needed to return the vegetation to an earlier successional stage. In a natural condition, this disturbance could be caused by wildfire, insects, diseases, or windthrow. Without human-made or natural disturbances, the forest tends to move toward a condition dominated by late successional vegetation such as sugar maple.

To obtain desirable natural regeneration of types such as aspen, red pine, or jack pine, clearcutting is the most effective method.

Temporary forest openings are created through the application of even-aged regeneration harvest such as clearcutting.

Clearcutting favors species of wildlife that utilize open and young growth habitat conditions or are well adapted to early successional vegetative types, such as the five-lined skink, golden-winged warblers, white-tailed deer, and ruffed grouse.

Table 4.5 shows the average annual acreage of harvest-clearcut by decade for each alternative, as well as the current level (1980 to 1984) of harvest-clearcut.

Table 4.5
Average Annual Acreage of Harvest-Clearcut by Decade

	Alternatives							
	1	2	3	4	5	6	7	8
Current level	4,817			(acres/year)				
Decade 1	2,570	2,300	6,790	1,600	---	3,090	4,860	5,470
Decade 2	1,550	4,190	4,690	2,550	---	1,950	4,300	3,160
Decade 3	4,090	3,860	3,160	2,560	---	3,440	4,390	2,520
Decade 4	1,660	1,150	4,220	1,720	---	1,470	4,925	3,200
Decade 5	7,340	5,240	8,800	6,590	---	4,040	6,600	7,670

Effects of Harvest-Clearcut

Clearcutting may significantly affect the visual, vegetation, and wildlife elements of the environment, as shown in Table 4.2.

Visual

Clearcutting can change the visual appearance of the forest significantly. The change will be from a continuous unbroken expanse of forest with only occasional openings to a broken forest with human-made temporary openings.

The length of time a temporary opening remains evident depends on the soils and tree species harvested by clearcutting. Whether an opening is planned for natural reforestation or artificial reforestation (planting) also has an effect on how long a temporary opening remains evident.

During actual timber sale operation, exposed soil, slash (logging debris), and logging equipment will be evident.

The average annual amount of clearcutting by alternative for the first 2 decades is shown on Table 4.5.

There is no clearcutting in alternative 5. Therefore, there would be no evidence of human-made temporary openings and the forest would eventually appear unbroken and there may be much less total variety of vegetation.

Alternative 3 has the highest amount of clearcutting. Under this alternative, there would be much evidence of human-made temporary openings throughout the Forest.

The amount of clearcutting in alternatives 7 and 8 in the first decade would be about the same or slightly more than current levels. Under these alternatives, human-made temporary openings would be more evident in some parts of the Forest than others. Many of these openings will be located where the opportunities to benefit the wildlife, vegetation, and visual resources is greatest. Vegetation variety would be high.

Alternatives 1, 2, 4, and 6 have low to moderate amounts of clearcutting. Under all these alternatives clearcutting would be less than the current level and evidence of human-made temporary openings will be rather evenly scattered across the entire Forest or located where the benefit to resources such as wildlife and visual quality would be greatest. The opportunity to create vegetation variety is good under these alternatives.

Vegetation

Harvest-clearcut practice significantly alters the existing vegetation through nearly complete removal of the high forest cover. This practice converts an area from predominantly tree cover to an open condition consisting of residue, grasses, herbaceous plants, and regenerating tree seedlings or sprouts. This practice results in even-aged stands of trees. Tree species that are shade-intolerant (aspen, jack pine) are likely to dominate the young stands following clearcutting.

The long-term forestwide effect of clearcutting on vegetation is a mosaic of temporary forest openings and even-aged stands of differing age classes, species composition, and condition. Harvest-clearcut, as a practice, tends to maintain the greatest diversity of plants and animals.

In combination with the harvest-shelterwood practice, clearcutting affects the vegetative composition and age class distribution across the Forest. Clearcutting is particularly important in providing temporary openings and young growth vegetative conditions. Harvest-clearcut is also the most important practice to maintain forest types such as aspen, red pine, and jack pine. It also plays a key role in management of insect and disease problems and in the efficient production of certain forest products. These effects will be discussed further in Part D of this chapter, Cumulative Effects.

The amount of clearcutting by alternative has some significant effects on the vegetation.

Alternative 5 would have no clearcutting. This alternative would lead to a forest condition dominated by northern hardwoods, following a significant reduction in aspen, paper birch, and conifer types such as jack pine, red pine, white pine, and hemlock. In addition, insect and disease problems would likely reach epidemic levels more frequently due to the overmature conditions in these types and the mix and amount of timber products provided would also be reduced significantly.

Alternative 3 has the highest amount of clearcutting, about a 20-percent increase over the current level, which would result in an increase in the aspen type and a more even mixture of early, mid and late successional community types as well as a more even mixture of hardwoods, aspen, and conifer vegetation. This

alternative would result in a much higher output of aspen products than other alternatives.

Although this alternative has the highest acreage of clearcutting, it is still lower than the amount that was planned in the most recent (1977) timber management plan for the Ottawa National Forest.

Alternatives 7 and 8 have a moderate amount of clearcutting, which is very close to current levels. These alternatives would maintain a moderate to high amount of aspen type and also produce moderate to high outputs of aspen products. These alternatives should have a relatively low risk of insect and disease problems because of their high level of vegetative diversity compared with alternatives with lower amounts of clearcutting.

Alternatives 1, 2, 4, and 6 have low to moderate amounts compared to current levels. These alternatives result in reductions in the aspen type and output of aspen products at or below current levels. These alternatives would maintain or slightly increase the risk of insect and disease problems associated with aspen, balsam fir, and jack pine.

Wildlife

Two major effects on wildlife result from the practice of harvest-clearcut. The first is the obvious change of habitat from an older forest condition to a newly regenerating forest condition. The second, less obvious effect is the sudden availability of soil nutrients in combination with sunlight on the forest floor to produce a flush of highly nutritious forage for browsing animals.

The first effect involves a change of wildlife species from those of a mature forest and treetops to those of young growth, shrub, and small trees. Forest-dwelling animals are represented by the northern goshawk and blackburnian warbler. Animals of temporary forest openings and young growth produced by harvest clearcut are represented by the white-tailed deer, black bear, and ruffed grouse.

Harvest-clearcut involves the decline of one kind of wildlife and the increase of another. Perhaps the decline of some animals and the increase of others, by itself, is not significant; only the extreme condition of one or another is important to consider. Thus on one hand, alternative 5 having no harvest-clearcut to maintain habitat for deer and other wildlife that live in openings and young growth represents one extreme. On the other hand, there is no alternative that has an extreme amount of harvest-clearcut. Alternatives 3, 7, and 8 provide habitat for deer and grouse at or somewhat more than the current level, yet still retain a dominant heavily wooded forest habitat. Alternatives 1, 2, 4, and 6 provide habitat for deer and grouse in amounts somewhat less than present.

The second major effect, the sudden availability of forage nutrients, should be thought of in proportion to the home range of a principal benefiting animal, for example, 10 acres or so for ruffed grouse; several hundred acres for deer. An alternative that would sustain forest practices within areas about the same size as the home range of the animal under consideration would be expected to provide for larger populations of the animal.

For the Ottawa National Forest, the level of demand for forest products has not been sufficient to allow a level of clearcutting needed to sustain high levels of game populations Forestwide. However, there is opportunity to coordinate and emphasize some management practices in areas ("opportunity areas") where numbers of hunters, deer, and grouse are historically higher, and in areas where management of young growth can be more effective in providing for public use of game species. Alternatives 3, 7, and 8 best utilize "opportunity areas." Alternatives 1, 2, 4, and 6 provide for some opportunities, about as practiced currently. Alternative 5 does not manage for young growth habitat.

Management Practice: Harvest-Thinning

Harvest-thinning is an intermediate harvest practice used in an even-aged silvicultural system. In a harvest-thinning, a portion of the trees are removed to allow more growing space for the trees being retained. This practice increases the growth and quality of residual trees and allows them to reach a mature size in a shorter period of time. Trees removed are generally of lower quality or less desirable species than those that they are competing with. A stand may receive one or more thinnings before being regenerated when the stand reaches a mature condition.

Table 4.6 shows the average annual acreage of harvest-thinning by decade for each alternative.

Table 4.6
Average Annual Acreage of Harvest-Thinning by Decade

	Current level	Alternative							
		1	2	3	4	5	6	7	8
	5,390	(acres/year)							
Decade 1		710	3,980	---	960	---	400	2,900	---
Decade 2		3,180	4,520	4,200	2,740	---	1,080	3,330	3,190
Decade 3		1,760	5,590	8,550	3,360	---	1,700	2,590	3,510
Decade 4		8,890	14,750	9,800	4,860	---	2,820	4,400	4,960
Decade 5		1,330	7,420	7,750	2,970	---	3,670	3,420	1,840

Effects of Harvest-Thinning

Harvest-thinning may significantly affect the vegetation element of the environment, as shown in Table 4.2.

Vegetation

Harvest-thinning can alter the vegetation and wildlife that utilize that vegetation in a much more subtle manner than the harvest-regeneration practice. The dominant species and age of the stand is not altered significantly by thinnings. However, slight changes in species composition and tree quality occur. Thinning tends to reduce the composition of short-lived, less valuable, or low-quality trees. This can improve the growth and quality of existing trees and improve future timber volume and quality. However, thinning also can remove individual cull or mast-producing trees utilized by cavity-nesting birds and mammals such as the hairy woodpecker, pileated woodpecker, and porcupine. These effects, however, can be mitigated by retaining selected trees where a need exists.

Alternatives with the higher amount of harvest-thinning generally place more emphasis on even-aged management of long-rotation species such as hardwoods, white spruce, and red and white pine.

Alternative 2 (current direction) has the highest amount of harvest-thinning which is actually slightly below current levels. No significant change from current conditions would be expected.

Alternative 5 has no thinning. The effects on the hardwood type would be a predominance of uneven-aged management. Harvest-selection would, in the short term, maintain hardwood stands in a manner similar to that which would exist if they were thinned. However, in the long term, the forest would be predominantly uneven-aged hardwoods. Types such as white spruce, red pine, and white pine would not be harvested, thus increasing the risk of insects and disease problems.

The remaining alternatives, except Alternative 7, have thinning at less than half the current level. No significant change from the current condition is anticipated.

This practice does contribute to the cumulative effects on the vegetation. Cumulative effects are further discussed in part D.

Management Practice: Harvest-Selection

Harvest-selection is a regeneration cutting practice used in an uneven-aged silvicultural system.

This practice involves the removal of individual trees with the objective of attaining a tree stand structure having a predetermined proportion of trees in the different size classes, that is, sapling, poletimber, and sawtimber. Growth is concentrated on the best trees. Harvest-selection cuts are used

to regenerate tree species that are shade tolerant, such as sugar maple and balsam fir.

Trees removed are generally of mature size, are highly defective or of low quality, or are competing for sunlight and soil moisture with trees which have greater potential for growth and increased value.

Harvests are accomplished at relatively short intervals, commonly 10 to 20 years. These harvests, which are repeated indefinitely, result in the continuous establishment of natural reproduction. This results in establishing and/or maintaining an uneven-aged structure.

Harvest-selection meets the needs of most high-forest, cavity-dwelling, closed canopy wildlife species. This method is least beneficial for wildlife species that use openings, edges, and low browse.

The visual resource is minimally affected by harvest-selection. This method provides for retaining a large-tree character in the landscape. To some, the frequent and repeated harvest operations and the extensive road system may be objectionable.

Table 4.7 shows the average annual acreage of selection harvest by decade for each alternative.

Table 4.7
Average Annual Acreage of Harvest-Selection by Decade

	Current Level	Alternatives							
		1	2	3	4	5	6	7	8
	1,424	(acres/year)							
Decade 1		380	1,500	3,000	3,000	6,450	4,000	3,800	2,500
Decade 2		620	1,500	---	9,360	11,250	10,300	7,000	7,760
Decade 3		5,160	4,630	3,000	6,680	11,160	5,840	8,000	6,600
Decade 4		6,230	1,500	---	9,380	11,250	11,070	7,800	7,960
Decade 5		5,160	4,630	3,000	6,680	8,940	5,830	8,000	6,600

Effects of Harvest-Selection

Harvest-selection may significantly affect the vegetation and wildlife elements of the environment, as shown in Table 4.2.

Vegetation

Each selection cut increases the amount of sunlight reaching the forest floor, which causes seeds to germinate and stumps to sprout. A new age class is then created in the stand.

Over time, management under an uneven-aged system tends to favor shade tolerant species such as sugar maple and reduce the relative abundance of less tolerant tree species. Management under the uneven-aged system produces large volumes of high

quality sawtimber over time with particular emphasis on sugar maple. High value tree species such as yellow birch, basswood, white ash, and northern red oak would be less common in a forest under uneven-aged management. Although diversity of tree species may be reduced, the diversity of size classes within the uneven-aged forest is increased. From a Forestwide perspective, a portion of the forest managed under an uneven-aged silvicultural system provides a unique community type.

Alternatives 5, 6, and 7 have the highest amount of harvest-selection and place emphasis on uneven-aged management of hardwoods. Alternative 5 has the highest and manages hardwoods exclusively under an uneven-aged system.

Alternatives 1, 2, 3, 4, and 8 have modest amounts of harvest-selection at or slightly lower than current levels, and place low emphasis on uneven-aged management of hardwoods.

Wildlife

Wildlife species that benefit from uneven-aged silviculture are those that benefit from vertical diversity where several layers of vegetation are present on the same site, such as forbs and seedlings at ground level, shrubs and saplings in the understory, poletimber in midstory, and larger trees in the canopy and super-canopy. Wildlife species that prefer biologically mature forests are present, as represented by the northern goshawk. Other wildlife species associated with early successional vegetation, such as deer and grouse, may be present but in small numbers.

Alternatives 4, 5, 6, and 7 provide two to four times the amount of habitat from harvest-selection the first decade as at present. Alternatives 2 and 8 are slightly higher than the current level. Alternative 1 is slightly reduced from the current levels.

Management Practice: Harvest - Shelterwood

The harvest-shelterwood practice is a series of cuts designed to regenerate even-aged stands.

In the harvest-shelterwood practice the mature stand is removed in a series of two or three cuts. The early cuts are designed to improve vigor and seed production of the remaining trees while preparing the site for new seedlings. The final harvest is made when a sufficient amount of desirable reproduction has become established and before the regeneration has reached 20 percent of its rotation age. This practice provides a partial cover of either large or small trees. When the shelter becomes a hindrance to the growth of the seedlings, rather than a benefit, it becomes necessary to remove the remainder of the mature stand. In northern hardwoods, research has found that this will occur within 10 years.

The harvest-shelterwood practice is most appropriate for species or sites where the shelter of a partial overstory is needed for reproduction, or to give desirable regeneration an advantage over less desirable species.

The shelterwood method provides conditions favorable to regeneration of a wide variety of hardwood and conifer tree species, such as yellow birch, eastern hemlock, and paper birch.

Tables 4.8, 4.9, and 4.10 show the average annual acreage of harvest-shelterwood practice (seed cut and shelterwood removal) and other removal cuts, by decade for each alternative.

Table 4.8
Average Annual Acreage of Shelterwood (Seed Cut) by Decade

	Current Level	Alternative							
		1	2	3	4	5	6	7	8
	350	(acres/year)							
Decade 1		3,150	960	---	1,600	---	1,270	1,210	410
Decade 2		175	380	---	---	---	720	1,050	130
Decade 3		630	50	2,150	720	---	420	990	2,230
Decade 4		1,770	2,190	1,770	1,860	---	780	1,660	2,000
Decade 5		3,460	2,560	3,880	870	---	1,200	1,780	1,000

Table 4.9
Average Annual Acreage of Harvest-Shelterwood (removal cut) by Decade

	Current Level	Alternative							
		1	2	3	4	5	6	7	8
	15	(acres/year)							
Decade 1		---	---	---	---	---	---	260	---
Decade 2		3,150	940	---	1,600	---	780	1,210	380
Decade 3		940	510	---	600	---	1,990	1,050	220
Decade 4		440	190	2,150	320	---	420	990	2,310
Decade 5		1,970	1,460	1,770	2,260	---	780	1,660	2,100

Table 4.10
Average Annual Acreage of Other Removal Cuts by Decade 1/

	Current Level	Alternative							
		1	2	3	4	5	6	7	8
	136	(acres/year)							
Decade 1		2,200	620	---	2,680	---	120	80	---
Decade 2		770	---	60	270	---	1,430	280	750
Decade 3		670	---	---	490	---	330	110	---
Decade 4		---	---	---	60	---	---	630	980
Decade 5		---	---	---	---	---	320	80	---

1/ Other removal cuts include cuts which remove a mature overstory from an understory which has become established without a prior seed cut. For the most part, this involves removal of an aspen overstory from an understory of hardwoods or balsam fir.

Effects of Harvest-Shelterwood

Harvest-shelterwood may significantly affect the vegetation, visual, and wildlife elements of the environment, as shown in Table 4.2.

Vegetation

Harvest-shelterwood significantly alters the vegetation from a condition featuring larger, mature forest to a condition which features young growth vegetation.

This practice along with site preparation activities provide desirable regeneration conditions for a variety of mid-tolerant to shade-tolerant hardwood and conifer species, such as red oak, yellow birch, red maple, white ash, sugar maple, hemlock, balsam fir, white spruce, white pine, and white cedar.

Species composition resulting from application of this practice is influenced by the soil-site conditions, residual species (seed source), seedbed conditions, and percentage of residual crown cover. This practice results in a variety of cover types ranging from predominantly conifer to predominantly hardwoods and a wide variety of mixtures in between.

For some forest cover types, the harvest-shelterwood practice is a management tool that offers unique opportunity to provide habitat conditions somewhat between that of harvest-clearcuts and harvest-selection cuts. For example, shelterwood cuts produce a two-storied habitat. Clearcuts result in single-story, and selection cuts result in multi-storied habitats. Shelterwood cuts produce more forage at ground level than selection cuts, but less than from clearcuts. The flush of forage under shelterwood cuts receives less sunlight than in a clearcut, and thus is less nutritious, but does not grow out of reach as fast.

For regenerating the northern hardwood cover types, however, clearcutting is not an option and the choice between shelterwood cuts and selection cuts may decide whether the habitat can retain a diversity of composition or whether the habitat takes on a dominant sugar maple composition. The harvest-shelterwood practice in combination with site preparation tends to regenerate a more diverse mix of tree species than regenerated by the harvest-clearcut practice or the harvest-selection practice.

Alternative 1 has the highest amount of harvest-shelterwood in the early decades. This alternative also emphasizes even-aged management of the hardwood type. This alternative, therefore, tends to improve the current age class distribution of the hardwood type which is predominantly in the 40-79 year age class.

Alternative 5 has no shelterwood cutting. The lack of even-aged regeneration harvest tends to move the forest toward a condition dominated by hardwoods with very poor diversity of cover types and age classes.

Alternative 3 provides for no harvest-shelterwood in the early decades, but provides moderate amounts in the later decades.

The remaining alternatives, 2, 4, 6, 7, and 8, provide low to moderate amounts. However, all of these alternatives represent a significant increase from current levels, and will result in improved age class distribution, particularly in the hardwood type.

Visual

The practice of harvest-shelterwood can change the visual appearance of the forest significantly. The harvest is completed in a series of cuts spaced out over many years. The change in the visual appearance results from both ground disturbance and changes in the existing vegetation. However, the practice of harvest-shelterwood, unlike harvest-clearcutting, always provides a partial cover of either large or small trees, thus reducing the visual appearance of the temporary opening.

During an actual sale operation, exposed soil, slash (logging debris), and logging equipment will be evident.

The acreage and amount of harvest-shelterwood by alternatives are shown in Tables 4.8, 4.9, and 4.10.

Alternative 1 has the highest amount of harvest-shelterwood in the first 2 decades. Evidence of change in the visual appearance of the Forest as the result of harvest-shelterwood would be greatest across the Forest in this alternative.

Except for a very small amount of shelterwood harvest in alternative 3, there is no shelterwood cutting in alternatives 3 and 5 in the first 2 decades. There would be no change in the

visual appearance of the Forest resulting from harvest-shelterwood cutting.

The remaining alternatives 2, 4, 6, 7, and 8 have a significant increase in shelterwood harvest over current levels. Under alternatives 2 and 4, the evidence of harvest-shelterwood would be scattered across the entire Forest. However, under alternatives 6, 7, and 8, the evidence of harvest-shelterwood would primarily be located where it would be of greatest benefit to vegetation and wildlife management.

Wildlife

Over time, harvest-shelterwood tends to benefit wildlife species associated with horizontal diversity, with each stand being largely of one age class, but with many stands of different age classes distributed over the landscape. Young growth from recent regeneration cuts attract white-tailed deer, particularly for winter browse. Mature forests are habitat for the goshawk. Many other wildlife species would live in these and intermediate-aged stands.

During forest regeneration, wildlife populations are moderated by the two or three stages of the harvest-shelterwood practice. Since the harvest-shelterwood (seed cut) produces a two-storied habitat, until the overstory is removed in ten years or so, wildlife species of both young forest and mature forest habitat may be found together here.

Ruffed grouse and other species that require herbaceous openings, shrubs, and small trees in full sunlight, such as aspen, would not be plentiful in areas of harvest-shelterwood.

Alternatives 1, 2, 4, 6, and 7 provide habitat from harvest-shelterwood at much increased amounts than the current level the first decade. Alternative 8 provides for slightly more than at present. Alternative 5 provides for no habitat from harvest-shelterwood. Alternative 3 provides for no habitat in the early decades, but would provide moderate amounts in the later decades.

Management Practice: Reforestation-Artificial

Reforestation-artificial practice involves a series of activities which generally includes mechanical or chemical site preparation followed by planting or direct seeding with trees or seed of desired species.

This practice is used in conjunction with even-aged silvicultural systems to regenerate cover types that are difficult to regenerate using reforestation-natural regeneration practices or, in some cases, is used to supplement natural regeneration efforts. This practice also provides an opportunity to introduce genetically improved stock resulting in significant gains in timber volume production.

Planting is most often used to regenerate somewhat pure, even-aged stands of red pine, jack pine, black spruce, or white spruce. However, recent nursery practices have made available limited amounts of rust-resistant white pine and larch, red oak, yellow birch, paper birch, black cherry, basswood, red maple, aspen, and hemlock.

Seeding has had very limited use but is being used primarily as a means of supplementing natural regeneration of such species as hemlock, jack pine, and black spruce.

Site preparation by means of a herbicide, prescribed burning, or mechanical methods, such as discing or scarification is generally done prior to planting or seeding to reduce residue (slash); control shrubs, sod, and other competition; or to expose mineral soil. The method of site preparation and planting or seeding is selected to be compatible with one another and with site conditions to achieve the management objectives in the most efficient manner.

Table 4.11 shows the average annual acreage of artificial reforestation by decade for each alternative, as well as the current level (1980 to 1984).

Table 4.11
Average Annual Acreage of Reforestation-Artificial by Decade

	Current Level	Alternative 1	2	3	4	5	6	7	8
	962	(acres/year)							
Decade 1		150	580	---	120	---	960	530	220
Decade 2		120	580	20	160	---	260	630	700
Decade 3		970	800	500	1,010	---	1,850	430	350
Decade 4		1,040	---	580	970	---	1,470	520	780
Decade 5		2,280	1,180	1,710	2,020	---	2,450	1,180	1,190

Effects of Reforestation-Artificial

Reforestation-artificial may significantly affect the vegetation and wildlife elements of the environment, as shown in Table 4.2.

Vegetation

Reforestation-artificial establishes forest stands by direct seeding or planting. The species composition and density of the reforested stand is more controlled than when natural reforestation methods are used.

In many cases, nearly pure stands of jack pine or red pine will result from this practice. These pure stands have very little within-stand diversity but may provide for increased cover type and age class diversity across a management area. In the past, large areas were planted at the same time with the same species. This practice resulted in a lack of vegetative diversity in these areas and in some cases insect and disease problems developed.

Reforestation of smaller areas, well distributed over space and time, will result in some positive impacts on the diversity of plant and animal communities by providing a mixture of cover types and age classes of artificially regenerated stands intermixed with natural stands of vegetation. Most of the negative effects associated with past reforestation-artificial practices can be avoided through proper location, design, and size of regeneration areas and matching suitable species to the site conditions.

This practice, used in conjunction with even-aged harvest practices, results in even-aged stands, usually consisting of a wide range of species, age class, and size class. Over time and space, the application of this practice results in a mosaic of forested stands including new regeneration, young growth, immature stands, mature stands, and overmature stands. With each stage of vegetative development is a corresponding community of wildlife species.

Alternatives 2, 6 and 7 have the highest amount of artificial reforestation ranging between slightly more than half to about equal to the current level.

All other alternatives show a significant reduction in artificial reforestation. This tends to maintain the conifer component of the forest at the somewhat low amount that currently exists.

Given the low level of this practice in these alternatives, the Forestwide impacts are minimal and all of them respond in a positive manner to concerns over planting pine.

Wildlife

The reforestation-artificial practice is used on this Forest primarily to establish red and jack pine plantations. Historically, these have proven to be poor habitat for many species such as deer and grouse. These dry-site conifer stands have their own species of wildlife, although few in numbers. Killdeer are seen after prescribed fire is used to prepare the site for planting. Magnolia warblers may be seen in new regeneration. A yellow-rumped warbler may nest in the pine a few years later.

It may be appropriate that some habitat for these species be available. Only five percent of the Forest, about 50,000 acres, is currently in red pine habitat at present. No major increases are planned in any alternative. Small increases in the type could be beneficial in terms of habitat diversity, given that the proper location, design, and size of regeneration areas and suitable species are matched to site conditions.

Alternative 6 proposes the largest acreage of reforestation-artificial in the first decade, about the current level. Alternatives 2 and 7 have about half the current level in the first decade. Alternatives 1, 4, and 8 are less. Alternatives 3 and 5 contain no provision for reforestation-artificial this decade.

Although the practice is considered significant on the acre being reforested, the net effect Forestwide of any alternative is not significant at the levels presented.

Management Practice: Reforestation - Natural

The reforestation-natural practice involves a series of activities that are usually associated with a regeneration harvest practice, such as harvest-clearcutting, harvest-shelterwood (seed cut), or harvest-selection cutting.

Reforestation-natural practices are designed to create site conditions favorable for the natural regeneration of a desired mix of tree species from seed or sprout sources.

Favorable site conditions are created through a combination of overhead vegetation and seedbed conditions. Overhead vegetation is manipulated to control seed source, sunlight, soil moisture, and temperature. The seedbed conditions provide for sites for germination and establishment of desired tree seedlings.

Site preparation for natural regeneration may include removal of residual trees from the stand following clearcutting, reducing residue, and preparation of a seedbed through scarification of the ground to expose the mineral soil.

Site preparation objectives may be accomplished through mechanical felling of residual trees, prescribed burning, herbicide applications, or mechanical methods such as discing or scarification.

The method of natural reforestation used is dependent on the mix of species desired to meet management objectives, soil-site conditions, competing vegetation, amount of residual trees and residue (slash) following harvest cutting, and available seed or sprout source. Another important factor is the timing of treatments to accomplish the desired results. For example, seedbed preparation should be done during a good seed year, just prior to seed fall. Regeneration from sprouting is often increased by scheduling harvest and site preparation during the dormant season.

Table 4.12 shows the average annual acreage of natural reforestation practice (which requires site preparation) by decade for each alternative.

Table 4.12
Average Annual Acreage of Reforestation-Natural (With Site Preparation) by Decade

	Current Level	Alternative							
		1	2	3	4	5	6	7	8
	2,797				(acres/year)				
Decade 1		4,150	1,390	5,770	1,800	1/	2,260	3,800	4,860
Decade 2		910	2,230	3,570	1,350	---	1,230	3,340	1,520
Decade 3		2,620	2,610	2,570	1,440	---	680	3,340	2,040
Decade 4		910	1,740	3,450	1,110	---	410	3,780	2,610
Decade 5		6,540	5,370	9,890	3,770	---	2,210	4,580	6,420

1/ This alternative including natural reforestation acres (without site preparation) due to selection harvest.

Effects of Reforestation-Natural

Reforestation-natural practices may significantly affect the vegetation and wildlife elements of the environment, as shown in Table 4.2.

Vegetation

Natural regeneration practices create a wide variety of vegetative conditions. Although regeneration objectives generally emphasize the establishment of one or more tree species, a mixture of species usually results from this practice. The mixture of tree species regenerated is the result of several environmental and biological factors such as the soil-site conditions, seed source, overstory cover, and seedbed conditions. This practice used in conjunction with even-aged harvest methods results in even-aged stands consisting of a wide range of species mixtures. Over time, the application of this practice results in a mosaic of forested stands from young growth to older, mature stands. A variety of species mixtures ranging from nearly pure jack pine stands to a very diverse mixture of hardwood and conifer species will result from the application of this practice.

Stands of mixed species provide a great deal of diversity within the stand, while the different age classes and cover type mixtures will provide a great deal of cover type and age class diversity. This will provide habitat conditions for a wide range of wildlife species.

Alternative 5 provides for no natural reforestation with site preparation, since it is limited to only uneven-aged management.

Alternative 3 has the greatest amount of natural reforestation, with about a 60 percent increase from current levels over the first 2 decades. This increase is associated primarily with a respective increase in clearcutting and regeneration of aspen.

Alternatives 2, 4, and 6 show a slight reduction from current levels while alternative 1 remains at about current levels. Alternative 2 has a reduced level due to the emphasis on longer rotations. Alternatives 4 and 6 has a reduced level due to emphasis on selection harvest in the hardwood type, which is regenerated without site preparation.

Alternative 1 has an increased emphasis in reforestation due to increased even-aged regeneration harvest in the hardwood type.

Alternatives 7 and 8 show slight increases in natural reforestation due to an increased emphasis in maintaining aspen type and regenerating mid-tolerant hardwoods.

Wildlife

Reforestation-natural is a forest practice frequently scheduled to prepare harvest-clearcut stands for regeneration. It is applied particularly to aspen and jack pine. It is also scheduled in conjunction with shelterwood harvest to regenerate hardwoods, white pine, and hemlock. Reforestation-natural ensures that aspen or jack pine habitat will be perpetuated and will not be crowded out by residual hardwood or balsam fir trees, which may occur if site preparation is used. Thus, reforestation-natural is important in the management of habitat for deer, grouse, and other animals associated with intolerant vegetation as regenerated by clearcut harvest.

Alternatives 1, 3, 7, and 8 provide for about the same or increased amount of shade intolerant vegetation during the first two decades compared with the current level. Alternatives 2, 4, and 6 provide for somewhat less than current levels. There is no reforestation-natural scheduled for alternative 5.

Management Practice: Release

Release is the practice of freeing a tree or group of trees from more immediate competition by cutting, or otherwise eliminating, growth that is overtopping or closely surrounding them. This practice is generally done in young established stands, to control the composition and density of trees.

This practice is often associated with the release of planted conifers such as red pine from competing hardwoods such as aspen. However, release is also practiced in young, mixed hardwood stands to increase the composition and competitive position of desired high valued species such as yellow birch.

Release can be accomplished using mechanical or chemical methods. Mechanical methods usually involve felling or girdling undesirable trees with hand tools. Chemical methods involve aerial or ground application of a selective herbicide in such a manner which will kill the undesirable tree species, without killing or excessively damaging the desired species.

The herbicide used, the amount of herbicide used, application methods and timing of application are critical considerations in achieving the desired results. All herbicide use must follow EPA label instructions and Ottawa National Forest standards and guidelines.

Table 4.13 summarizes the average annual acres of release practice by decade for each alternative.

Table 4.13
Average Annual Acres of Release by Decade

	Current Level	Alternative 1	2	3	4	5	6	7	8
	1,308				(acres/year)				
Decade 1		---	140	---	---	---	1,000	900	180
Decade 2		800	270	50	660	---	1,200	650	220
Decade 3		50	440	---	50	---	200	450	350
Decade 4		850	---	---	780	---	1,100	450	210
Decade 5		1,100	530	1,360	1,000	---	3,100	930	720

Effects of Release

Release may significantly affect the vegetation element of the environment, as shown in Table 4.2.

Vegetation

Release can alter the vegetation and the wildlife that utilize it in a more subtle manner than harvest or reforestation practices. The release practice tends to alter the vegetative composition of the stand slightly in favor of a desired tree species over less desired species. In most cases, the less desired species are not completely eliminated, but rather reduced to a point where they are less competition for the desired species or individual trees.

Therefore, the release practice tends to reduce within-stand diversity and reduce the number of wildlife species that may utilize the site following release. However, from a Forestwide perspective, the vegetation types that are released in any given year are a very small component of the mosaic of vegetative conditions across the Forest and provide some unique plant and animal communities, such as a young pine plantation.

All of the alternatives provide for a reduction in release acreage from current levels. Alternative 6 has only a slight reduction from current levels.

Alternative 5 includes no release. Alternative 3 includes a negligible amount.

The remaining alternatives 1, 2, 4, 7, and 8 provide for significant reductions in release from current levels, ranging from 15 to 70 percent of the current level over the first two decades. This general decline is due to the reduced emphasis in conversion to conifers on the Forest and to an increase in emphasis on natural reforestation.

All of the alternatives respond in a positive manner to concerns expressed over chemical use. Although chemical release would still be used in all alternatives except 3 and 5, the use would be less than the current or past levels.

Management Practice: Precommerical Thinning

Precommercial thinning is a timber stand improvement practice conducted in young stands of timber to improve species composition, growth rate, and form of remaining trees. Trees removed are generally of lower quality or less desirable species than those that they are competing with. A single precommercial thinning may be conducted prior to the stand being operable for commercial thinnings.

The effects on vegetation and wildlife from precommercial thinning is similar to harvest-thinning and is adequately covered in the discussion under the management practice harvest-thinning.

No significant effects of precommercial thinning are anticipated in any alternative. All potential effects on cultural, wildlife, endangered and threatened species, and recreation can be mitigated.

Problem 5 - Wilderness

The Ottawa National Forest currently contains no components of the National Wilderness Preservation System. However, the second Roadless Area Review and Evaluation (RARE II) identified portions of the Ottawa National Forest as roadless areas that should be evaluated for their wilderness potential. These areas were Sylvania, Sturgeon Gorge, and Norwich Plains (formerly Cascade Falls).

These areas were further evaluated as part of the Forest planning process because of the Ninth Circuit Court of Appeals decision in California v. Block. This decision put into question the sufficiency of the RARE II process. Following completion of the public involvement phase of the further evaluation process the Cyrus H. McCormick Experimental Forest was added to the list of roadless areas to be evaluated.

Management Practice: Wilderness Designation

Wilderness designation can only occur following enactment of legislation passed by the Congress of the United States and signed by the President.

Management of wilderness is directed by the Wilderness Act and any specific legislation enacted by Congress for each unique wilderness.

As defined by the Wilderness Act of 1964, a wilderness is an "area of undeveloped Federal land retaining its primeval character and influence . . . which is protected and managed so as to preserve its natural conditions." Wilderness areas provide opportunities for solitude and primitive recreation in a natural ecosystem.

Areas considered for wilderness study or nonwilderness management were Sylvania, Norwich Plains, and Cyrus H. McCormick Experimental Forest.

The Sturgeon Gorge Roadless Area was designated a "wilderness study area" by Congress for study by the USDA-Forest Service in 1975. This area was considered for wilderness, wilderness study, or nonwilderness management.

Areas recommended for wilderness study or wilderness designation are listed in Table 4.14.

Table 4.14
Roadless Area Acreage Selected for Wilderness Designation or Wilderness Study

Alternatives	Roadless Area				
	Sturgeon Gorge	Sylvania	Norwich Plains	Cyrus H. McCormick Experimental Forest	Total
	(in net acres)				
1	14,849	18,327	0	16,850	50,026
2	14,849	18,327	4,212	0	37,388
3	0	0	0	0	0
4	14,849	18,327	7,684	16,850	57,710
5	14,849	18,327	0	0	33,176
6	0	18,327	0	0	18,327
7	14,849	18,327	0	16,850	50,026
8	14,849	18,327	0	0	33,176

Analysis of environmental effects discussed under this management problem is based on the premise that roadless areas would be designated wilderness whether the area is recommended for wilderness designation or wilderness study.

After enactment of designating legislation, a management prescription for each wilderness area would be developed recognizing its unique characteristics and any special legislation requirements.

A detailed discussion on the effects of roadless area management based on wilderness attributes of the four roadless areas further evaluated can be found in the Final EIS Appendix Volume, Appendix C - Roadless Area Evaluation. That discussion will not be repeated here.

Effects of Wilderness Designation

Wilderness designation may significantly affect the minerals, roads, vegetation, wildlife, and recreation elements of the environment, as shown in Table 4.2.

Minerals

Common variety minerals will not be developed in wilderness areas. Surface-disturbing exploration and extraction of federally owned minerals will not be permitted in wilderness areas.

Privately owned minerals that are not acquired by the federal government can be developed by the owners. Such development will cause a loss of wilderness environmental values, such as solitude, undisturbed landscape, and natural vegetation in the wilderness areas.

Roads

All roads and other related developments will be closed and would slowly deteriorate. Some roads would be converted to trails.

Private landowners within the wilderness areas retain their rights of reasonable access and use of their lands and facilities. They would be encouraged to manage and use their lands in harmony with wilderness values and management practices carried out on the surrounding federally owned lands.

Vegetation

Wilderness management of vegetation is limited to protection of wilderness values or to protect adjacent property from fire or pests. Timber is not harvested.

Vegetative cover in wilderness will eventually resemble the early forests. Shade-tolerant hemlock and sugar maple would likely be the most common tree species. Sugar maple will probably replace hemlock as the major vegetation.

Cover type and age class diversity will decrease with time and will establish and maintain a forest of mature and overmature trees of large size. However, from a Forestwide perspective, this early forest condition would increase the range of vegetative conditions.

Natural disturbances, such as fire and windthrow, will create additional plant diversity represented by stands in various stages of recovery from these natural catastrophies.

Wildlife

In areas with wilderness designation, age class diversity is expected to increase over present conditions. As vegetational layers become more complex, a greater number of habitat niches will become available, especially for wildlife species of mature forests.

Eventually, wilderness management will result in an increase of cavity-nesting birds and mammals represented by the northern goshawk and blackburnian warbler. Populations of wildlife species associated with early successional habitat, such as deer and grouse, will decline.

Recreation

Wilderness would provide areas managed specifically to provide opportunities for recreation in a setting that is semiprimitive nonmotorized, isolated, close to nature, and with some challenge and risk. Fishing, hunting, and trapping are allowed; however, access is limited to hiking and use of nonmotorized equipment such as canoes.

PART D. CUMULATIVE EFFECTS

Part D describes the cumulative effects of the alternatives on each environmental element. The cumulative effects of an alternative are the result of the application of management practices discussed in Part C of this chapter. For example, the cumulative effects on wildlife result from the management practices of local road construction, harvest-clearcut, harvest-selection, reforestation-artificial, reforestation-natural, and wilderness designation.

Each alternative involves a different mix of practices in response to the management problems. Therefore, each alternative will create different overall wildlife habitat conditions. In assessing the cumulative effects of an alternative, the interdisciplinary team considered the quantity of each practice, where the practices would be applied, and over what timeframe. Then the magnitude of the qualitative direct and indirect effects, as described in Part C of this chapter, were evaluated.

Chapter II of this document discusses important features within each alternative. Chapter III of this document discusses the existing condition and provides a basis for comparison of the alternative relative to the existing condition.

The discussion in this part follows the sequence of environmental conditions shown in Table 4.2.

Soil Productivity

The cumulative effects on the soil productivity are primarily a result of the local road construction practice.

Since the impact on soil productivity is in proportion to the rate at which local roads are constructed, the cumulative effect is directly related to the miles of local roads constructed (see Table 4.3).

In the short term, alternatives 1, 2, 3, 4, 5, 7, and 8 have a lower impact than alternative 6. In the long term, all alternatives have a much lower impact than the current level.

Minerals

The local road construction and wilderness designation management practices constitute the cumulative effects on the minerals environmental element. The impact of local road construction is similar to soil productivity (see Table 4.3) and is directly related to the amount of local road construction. Wilderness designation will prohibit the use of common variety minerals and surface-disturbing exploration and extraction of federally owned minerals. Table 4.15 displays the acres removed from use of federally owned minerals.

Table 4.15
Acres of Federally Owned Mineral Rights Not Available for Surface Disturbing Exploration of Minerals by Alternative by Roadless and Research Natural Areas.

Roadless Areas	Alternatives 1	2	3	4	5	6	7	8
			(acres)					
Sturgeon Gorge 1/	1,870	1,870	210	1,870	1,870	210	1,870	1,870
Sylvania 2/	1,240	1,240	-	1,240	1,240	1,240	1,240	1,240
Norwich Plains 2/	-	700	-	700	-	-	-	-
Cyrus H. McCormick Experimental Forest 3/	4,715	4,715	4,715	4,715	4,715	4,715	4,715	4,715
Total 4/	8,035	8,735	4,925	8,735	8,035	6,165	8,035	8,035

1/ Contains proposed research natural area (RNA) (210 ac.) which prohibits exploration and extraction of minerals. The federal government owns all mineral resources within proposed research natural area. Based on a U.S. Geological Survey survey, there is little potential for mineral development.

2/ Includes Sylvania candidate RNA. Potential exists for sulfides, phosphates, oil, and gas throughout the areas.

3/ The established research natural area prohibits exploration and extraction of minerals. About 1,040 acres of federally owned minerals are outside the RNA and within the Cyrus H. McCormick Experimental Forest. Based on current knowledge, there is no foreseeable potential for mineral resources within the area.

4/ The removal of this amount of land from the surface-disturbing base will not alter the capability to manage federal minerals.

Common variety minerals in roadless areas recommended for wilderness designation or wilderness study in the alternatives have not been completely inventoried but their location and knowledge of landform and soils indicate their removal as a potential source would have a minor effect on the total availability on the Forest. This portion of the minerals impact would be insignificant for all alternatives.

Alternatives 3 and 6 appear to represent a lower effect group for use of common variety minerals for local road construction and restriction of oil, gas, and hard rock exploration and extraction due to wilderness designation. Alternatives 1, 5, 7, and 8 represent a moderate effect group, and alternatives 2 and 4 represent a higher effect group.

However, in assessing the cumulative effects on minerals, the actual mineral potential should be considered in weighing the effect. Although Sturgeon Gorge has 1,870 acres of federally owned minerals, there is a low potential for actual mineral development. Sylvania and Norwich Plains Roadless Areas have known mineral potentials but total federally owned minerals are less than 2,000 acres for both areas. Presently, the McCormick Research Natural Area (3,572 acres) is not available for

exploration and extraction and this does not vary by any of the alternatives. Furthermore, at this time, there is no known mineral potential within the Cyrus H. McCormick Experimental Forest.

Visual

The cumulative effects on visual resources result primarily from the obvious evidence of human-made corridors and temporary openings in the forest as the result of local road construction, harvest-clearcut, and harvest-shelterwood management practices.

Each of the management area prescriptions has visual quality objectives (VQOs) built into management direction. VQOs represent the desired level of acceptable disturbance of the existing characteristic landscape based on the public's sensitivity and the existing variety of the landform, rockform, vegetation, and water in the forest landscape for any area of the Forest.

There are five visual quality objectives. They are preservation, retention, partial retention, modification, and maximum modification. Visual quality objectives of preservation, retention, and partial retention mean evidence of human disturbance will not be noticeable or so noticeable as to normally attract the attention of forest visitors. They are indicative of more natural appearing conditions. Modification and maximum modification VQOs mean just the opposite. Evidence of human disturbance will be noticeable and may attract the attention of forest visitors.

The major visual difference between alternatives is whether one will provide a more natural appearing forest than another. The amount of some management area prescriptions in any one alternative has a direct relationship to this comparison.

The greater the amount of management areas 1.1, 3.1, 3.2, and 4.2, the more management practices harvest-clearcut and harvest-shelterwood are emphasized. As a result, as the amount of these management areas increase so does evidence of human activity, primarily evenaged timber harvest creating temporary openings in the forest.

On the other hand, in comparison, the more the amount of management prescriptions 2.1, 4.1, 6.1, 6.2, 7.1, 8.1, thru 8.3 and 9.1 through 9.3, the less evidence there is of human activity. This is the result of unevenaged timber harvest, wilderness management and protection and special areas management such as the Sylvania perimeter area. However, evidence of local roads is greatest in management areas where unevenaged timber harvest is emphasized such as in management areas 2.1 and 4.1.

The amount of Forest assigned to management area prescriptions by alternatives is shown in Table 4.16.

Table 4.16
Percentage of Forest Assigned to Management Prescriptions by Alternatives

Management Area	Alternatives							
	1	2	3	4	5	6	7	8
	(percent of Forest)							
1.1	6	8	12	3	-	7	7	1
2.1	6	6	-	-	40	32	39	34
3.1	3	4	5	-	-	13	6	1
3.2	42	58	53	33	-	-	15	25
4.1	5	11	3	5	-	6	7	7
4.2	7	<1 1/	4	7	-	5	1	4
5.1	-	-	-	-	-	-	-	-
6.1	5	-	7	8	6	9	7	6
6.2	12	-	5	29	6	11	6	10
7.1	<1	<1	<1	<1	<1	<1	<1	<1
8.1a	-	2	-	-	-	-	-	-
8.1b	-	-	2	-	2	2	-	2
8.2	<1	<1	<1	<1	<1	<1	<1	<1
8.3	-	-	2	-	-	-	-	-
8.4	-	<1	<1	<1	<1	<1	-	<1
9.1	6	4	-	7	4	2	6	4
9.2	5	5	5	5	5	5	6	5
9.3	3	-	1	2	37	8	<1	1

1/ <1 means less than 1 percent.

Alternatives 2 and 3 have the greatest cumulative effect on the visual resources. As a result, the evidence of human disturbance in the Forest would be high under these alternatives. Under these alternatives, more than 70 percent of the Forest is assigned management area prescriptions that emphasize even-aged management which include harvest-clearcut and harvest-shelterwood management practices.

Under these alternatives, it could be difficult to meet visual quality objectives in some areas of the Forest.

Alternative 5 would have the least cumulative effect on the visual resource. Evidence of human-caused disturbance would be least evident under this alternative. Alternatives that emphasize even-aged management are not assigned to management areas under this alternative. It would be easiest to meet visual quality objectives across the Forest; however, vegetation variety would be less in the future.

Alternatives 1, 4, 6, 7, and 8 have a low to moderate cumulative effects on the visual resource. Evidence of human-caused disturbance would vary from low to moderate across the Forest. Under these alternatives, 26 to 56 percent of the Forest is assigned management area prescriptions that emphasize even-aged management. The remaining forest land area is assigned management area prescriptions that emphasize uneven-aged, special, or protection management.

Even-aged management would be emphasized where harvest-clearcut and harvest-shelterwood practices can be of greatest benefit to wildlife and vegetation management.

Maintenance and creation of vegetation variety is greatest under these alternatives.

Visual quality objectives could be met under all alternatives. However, it would be easiest in alternatives 4, 5, 7 and 8 because a balance of management area prescriptions emphasizing both even-aged and uneven-aged management is provided.

Roadless Areas

There are four roadless areas on the Forest that were evaluated for recommendation for wilderness study or designation. The roadless areas are Sylvania, Norwich Plains, Sturgeon Gorge, and the Cyrus H. McCormick Experimental Forest.

The cumulative effect of roadless areas is the amount (acres) and location of roadless areas recommended for wilderness study or designation under each alternative.

Roadless areas recommended for wilderness study or designation are listed in Table 4.14 in Part C of this chapter.

Under alternative 3, no roadless areas are recommended for wilderness study or designation.

Alternative 5 and 8 recommend two areas, the Sturgeon Gorge and Sylvania roadless areas, for wilderness study, a total of 33,176 acres.

Alternative 7 recommends three areas, the Sturgeon Gorge area for wilderness designation and the Sylvania and Cyrus H. McCormick Experimental Forest areas for wilderness study, a total of 50,026 acres.

Alternative 4 recommends all roadless areas on the Forest for wilderness study, a total of 58,028 acres.

Refer to Final EIS Appendix Volume, Appendix C-Roadless Area Evaluation for a complete discussion of the effects of recommending the amount and areas listed in Table 4.14 for wilderness study or designation.

Roads

The cumulative effects on the road system are the result of local road construction and wilderness designation management practices. This system should allow access to and efficient transportation of forest products to markets and at the same time provide access to the Forest for other activities such as hunting in a variety of recreation settings. It also must recognize the environmental values of the roadless areas being considered for wilderness designation or study.

Local roads are constructed meeting one of three standards listed below and will to the maximum extent possible, utilize existing road locations and abandoned railroad grades:
- Winter only,
- Winter/dry summer,
- Summer normal.

Refer to Chapter IV, Forestwide standards and guidelines for more information concerning the design standards for local roads.

The average annual miles of new local road construction by standards and alternatives are listed on Table 4.17.

Table 4.17
Average Annual Miles for First 2 Decades of New Local Road Construction by Standard

Road Standard	Current	Alternatives 1	2	3	4	5	6	7	8
		(average miles per year)							
Total	41	29	28	28	33	33	43	38	34
Winter only		12	10	11	14	16	17	15	14
Winter/dry summer		10	10	9	10	9	13	13	10
Summer normal		7	8	8	9	8	13	10	10

All alternatives except alternative 3 recommend wilderness study or designation for one or more roadless areas on the Forest. Under these alternatives, all roads within areas recommended for wilderness designation or study will be closed to motor vehicle use and converted to hiking trails where appropriate. Currently, some motor vehicle use for administrative use only is permitted in the Sylvania, Cyrus H. McCormick Experimental Forest, and Norwich Plains roadless areas. Also, some roads in Sturgeon Gorge are open for public off-road vehicle use. Under wilderness management, motor vehicles can only be used for emergency situations or other special situations regarding the protection of adjacent lands such as preventing the spread of wildfire.

Alternatives 1, 2, and 3 contain the lowest average annual miles of local road construction in the first two decades. This is the result of concentrating management activities where fewer roads are needed and winter logging is emphasized, and because of the high amount of the Forest being managed for semiprimitive motorized and nonmotorized recreation opportunities. These areas would have the least amount of new local roads constructed in them.

Alternative 6 has the highest amount of local road construction. This is the result of emphasizing unevenaged management to produce quality northern hardwood sawlogs. This kind of vegetation management requires a higher density of permanent roads. However, more than 20 percent of the Forest would be managed to provide semiprimitive motorized and nonmotorized recreation opportunities. Local roads in semiprimitive motorized areas would be closed to passenger vehicles, however, would be available for use by ATV type vehicles including snowmobiles.

Alternatives 4, 5, 7, and 8 would have a moderate average annual amount of local road construction.

This is the result of having management prescriptions assigned to these alternatives that prescribe moderate road densities of 1 to 3 miles per square mile on more than 50 percent of the Forest. Aspen management is emphasized in all of these alternatives which can be accessed by temporary roads. Alternative 4 also provides a high amount of semiprimitive motorized recreation opportunities which prescribes a low road density of 1 to 2 miles of road per square mile. Alternative 8 also provides for uneven-aged management of northern hardwoods, concentrating harvest activities where winter logging is emphasized. In combination, these alternatives each have a cumulative effect of providing moderate amounts of new local road construction with all emphasizing the winter-only standard.

Vegetation

The vegetative conditions that are provided over time result from a combination of natural and man caused forces. Many natural forces, such as damage caused by wind, ice, rain, drought, and flooding will not change by alternative. Some natural forces, such as insect, disease, and fire may change by alternative as a result of the management direction of the alternative.

The vegetative conditions of the Forest are described in terms of the mix of vegetative types and the age class distribution of types across the Forest.

The long-term vegetative conditions that result on forest land suitable for timber production is in great part due to the cumulative effects of vegetation management practices including harvest-clearcut, harvest-thinning, harvest-selection, harvest-shelterwood, reforestation-artificial, reforestation-natural, and release.

In addition, roads have a significant effect in terms of providing the access needed to manage the vegetation.

Table 4.18 displays the long-term vegetative composition by alternative.

Table 4.18
Long-Term Vegetative Composition

Vegetative Type	Current Level	Alternative 1	2	3	4	5	6	7	8
	(thousand acres)								
Northern hardwoods	423	435	411	391	435	422	413	422	437
Aspen and paper birch	186	148	175	203	149	187	131	162	152
Spruce-red and white pine	58	65	85	74	66	58	100	73	67
Balsam fir and jack pine	84	103	80	83	101	84	107	96	95
Hemlock	28	28	28	28	28	28	28	28	28
Swamp conifer	57	57	57	57	57	57	57	55	57
Nonforest	90	90	90	90	90	90	90	90	90
Total	926	926	926	926	926	926	926	926	926

The acreage in this table includes both forest land suitable for timber production and those unsuitable for timber production. The acreage that is unsuitable will generally not receive vegetative management. Therefore, the vegetative type may change through time due to natural succession.

For example, aspen acreage that is unsuitable may convert naturally over time to hardwoods or balsam fir. However, these changes were not estimated or reflected in these tables. Therefore, readers can make their own assumptions on how the unsuitable acres of vegetation may change over time.

Table 4.19 displays the acreage of land unsuitable for timber production by alternative.

Table 4.19
Forest Land Unsuitable for Timber Production by Vegetative Type

Vegetative Type	Alternative 1	2	3	4	5	6	7	8
	(thousand acres)							
Northern hardwoods	32	77	103	54	208	203	144	152
Aspen and paper birch	51	59	17	83	186	55	24	23
Spruce-red and white pine	2	14	9	5	57	2	11	13
Balsam fir and jack pine	21	23	19	23	73	31	41	28
Hemlock	5	11	6	15	27	10	14	13
Swamp conifer	22	20	20	21	53	20	40	35
Nonforest	90	90	90	90	90	90	90	90
Total	223	294	264	291	704	411	364	354

The change in vegetative composition is more predictable for forest land suitable for timber production, where vegetative management practices are scheduled.

Table 4.20 summarizes the acreage of forest land suitable for timber production by alternative and vegetative type.

Table 4.20
Forest Land Suitable for Timber Production by Vegetative Type

Vegetative Type	Alternative							
	1	2	3	4	5	6	7	8
	(thousand acres)							
Even-aged mangement hardwoods	289	272	258	221		48	113	125
Uneven-aged management hardwoods	114	62	30	160	222	162	165	160
Aspen and paper birch	97	116	186	66		76	138	129
Spruce-red and white pine	63	71	65	61		98	62	54
Balsam fir and jack pine	82	57	64	78		76	55	67
Hemlock	23	17	22	13		18	14	15
Swamp conifer	35	37	37	36		37	15	22
Total	703	632	662	635	222	515	562	572

The mix of even-aged and uneven-aged hardwood management and the acreage of aspen type maintained are the major types on the Forest and also show the greatest variation by alternative.

Alternative 1, for example, places high emphasis on even-aged management of hardwoods and low emphasis on management of the aspen and paper birch type, but has a very low amount of uneven-aged hardwood management.

Alternatives 7 and 8 provide a somewhat equal mix of even-aged and uneven-aged management of hardwoods while maintaining moderate to high amounts of aspen and paper birch when compared to other alternatives.

The distribution of the age classes also varies by alternative as a result of the long term application of vegetative management practices.

Table 4.21 displays the present and long-term age class distribution of vegetation on acres suitable for timber production by alternative.

Table 4.21
Age Class Distribution of Vegetation Present and Long-Term (150 years) for Suitable Acres

Age Class	Present Forest 1/	Alternative 1	2	3	4	5	6	7	8
				(thousand acres)					
Nonforest									
0-19 years	66	96	98	145	63	-	92	92	117
20-39	37	174	115	146	147	-	119	124	96
40-59	285	126	148	99	102	-	69	83	83
60-79	219	85	58	143	63	-	39	53	50
80-99	49	60	138	99	51	-	28	37	54
100+	64	48	12	-	49	-	6	8	12
Uneven-aged aged	108 2/	114	62	30	160	222	162	165	160
Total	828	703	632	662	635	222	515	562	572
100+ unsuitable acres 3/		125	196	166	193	606	313	266	256

1/ Based on tentatively suitable acres.
2/ 36 percent of these acres are in a two-age condition.
3/ Acres of unsuitable Forest land that would grow into the 100+ age group in the long-term.

The balance of age classes is improved in all alternatives except 5 when compared to present.

Alternatives 3, 7, and 8, that place a higher emphasis on short rotation types such as aspen, paper birch, balsam fir, and jack pine, have more acres in the younger age classes.

Alternatives such as 5 and 6 that emphasize uneven-aged management of hardwoods tend to have fewer acres in any given age class compared to the other alternatives.

Older age conditions occur in the unsuitable acres as well as the older age classes and uneven-aged class.

Insect and disease problems are very difficult, if not impossible, to predict. However, some alternatives can be considered a higher risk based on the vegetative conditions that result due to vegetative management practices or more importantly the lack of vegetative management.

Conditions that increase risk of insect and disease outbreaks include large acreages of overmature trees or the preponderance of one cover type or age class.

In general, alternatives that provide a greater amount of vegetative diversity distributed across the Forest would probably have the lowest risk of insect and disease problems. However, some vegetative types have historically been plagued with more insect and disease problems than others. White spruce, and red and white pine types along with jack pine and balsam fir types have been harder hit by insect and disease problems on the Forest.

Alternative 5, which has no even-aged management in any forest type, results in many acres unsuitable for timber production and creates more overmature conditions and could result in an increased risk of insect and disease outbreak when compared to other alternatives.

Alternatives such as 1, 2, 3, and 4 that favor even-aged management of the hardwood type could result in more within-stand species diversity and also more age class diversity within the hardwood type. Although no major insect and disease problems have affected sugar maple, the increase in species diversity should reduce the risk of loss due to insect and disease problems slightly in these alternatives compared to alternatives that emphasize uneven-aged management featuring sugar maple.

The reader should note the tables displaying the vegetative compostion, age class distribution, and acres of unsuitable forest land by vegetative type and reach their own conclusions as to which alternatives provide more vegetative diversity and also which alternatives would have the lowest risk of insect and disease outbreaks.

Timber Production

The level of timber production and the mix of species and products provided by an alternative is the result of the schedule of vegetative management practices.

Harvest practices such as harvest-clearcut, harvest-thinning, harvest-selection, and harvest-shelterwood cutting all contribute to the production of timber products.

Practices such as reforestation-artificial, reforestation-natural, release, and precommercial thinnings provide for a long-term sustained yield of timber in the future.

The schedule and type of harvest in various vegetative types influences the mix of species products provided.

The level of demand for timber products and the intensity of management influences the amount of forest land suitable for timber production.

The revenues generated from timber production in any alternative are influenced primarily by the species and product mix, since some species and products such as hardwood sawtimber, are of much higher value than others, such as aspen pulpwood.

Table 4.20 summarizes the acreage of forest land suitable for timber production by alternative and vegetative type as shown in the previous part of this chapter.

Some alternatives such as alternative 1 place a relatively high emphasis on even-aged management of hardwoods and low emphasis on management of the aspen type for timber production. Alternative 3 places emphasis on management of the aspen type for timber production. Alternatives 7 and 8 place emphasis on a mix of even-aged and uneven-aged management of hardwoods, along with a moderate amount of aspen type management for timber production.

Table 4.22 displays the volume of timber that would be produced (supplied) by alternative. The table shows the level supplied by species and product group. The table also shows the current level (1980-1984) of timber sold, and the anticipated level demanded by decade, for each species product group.

Table 4.22
Timber Volume Scheduled for Removal

Species/product group	Amount Demanded 2/	Annual Volume Scheduled for Removal Alternative 1	2	3	4	5	6	7	8
		(million cubic feet annually)							
Hardwood sawtimber (current level 1.5)									
Decade 1	2.1	2.1	0.8	1.1	1.4	0.5	1.7	1.8	1.2
2	2.5	3.6	2.5	1.7	3.6	1.4	2.3	2.4	2.9
3	2.5	3.9	3.9	1.8	3.9	3.9	3.9	4.1	3.2
4	3.0	5.0	5.0	4.4	5.0	5.0	5.0	5.0	5.0
5	3.3	6.0	6.0	6.0	6.0	6.0	6.0	6.2	6.0
Hardwood pulpwood (current level 2.0)									
Decade 1	3.3	3.8	3.8	3.8	3.8	3.8	3.8	4.3	3.8
2	5.6	6.5	4.8	6.5	7.2	5.6	7.8	7.4	6.8
3	6.8	5.4	6.0	10.0	5.2	2.9	4.4	6.5	9.0
4	8.0	7.7	9.9	8.4	6.1	4.0	4.8	7.0	7.0
5	8.9	3.2	3.6	4.2	2.8	2.7	5.0	2.8	2.4
Aspen sawtimber and pulpwood (current level 3.3)									
Decade 1	4.1	3.0	3.1	3.6	3.7	0.5	1.9	4.1	3.6
2	6.3	2.5	3.2	5.6	1.7	1.0	4.2	4.6	4.5
3	7.6	4.3	3.4	6.4	2.6	0.2	3.2	5.4	7.0
4	8.9	2.0	2.5	6.7	1.6	-	0.3	5.9	6.7
5	10.2	9.0	8.2	8.5	7.9	-	3.7	6.5	8.5
Softwood sawtimber (current level 0.9)									
Decade 1	0.7	2.2	1.3	2.1	2.2	0.1	2.2	1.6	2.1
2	0.7	3.6	3.7	3.0	3.6	0.5	2.4	2.6	3.2
3	0.8	5.8	5.3	2.7	5.3	1.4	5.9	4.5	2.9
4	0.9	8.2	4.5	4.7	8.8	2.5	8.0	5.9	5.8
5	1.0	8.5	7.4	7.8	8.6	0.6	8.8	8.1	7.6
Softwood pulpwood (current level 2.6)									
Decade 1	2.9	2.0	2.1	2.1	2.0	0.2	1.4	1.4	2.1
2	3.9	2.9	2.5	2.1	2.8	0.4	2.2	2.0	2.3
3	4.6	2.8	3.3	1.4	3.4	0.2	2.7	1.8	1.2
4	5.3	2.8	2.3	1.8	2.3	0.2	3.0	2.1	1.5
5	5.8	2.4	1.6	1.4	2.7	-	1.9	2.3	1.5
Total timber (current level 10.3)									
Decade 1	13.1	13.1	11.2	12.7	13.1	5.2	11.0	13.1	12.8
2	19.0	19.0	16.8	19.0	19.0	8.7	19.0	19.0	19.0
3	22.3	22.3	21.9	22.3	20.4	8.7	20.2	22.3	22.3
4	26.0	25.7	24.0	26.0	23.8	8.7	21.2	25.8	26.0
5	29.2	29.2	26.9	27.9	28.0	8.7	25.5	25.8	26.0
Long-term sustained yield capacity		31.0	29.0	28.0	29.8	9.7	25.5	26.7	26.0

1/ A simplified conversion to million board feet can be made by multiplying each number by 5.4.

2/ These figures represent initial estimates of demand which timber consumers have for timber products from the Ottawa. They have not been adjusted to reflect uncertainty nor do they reflect the possibility that other timber products may be acceptable substitutes in many cases. Ref. EIS Appendix B6-20-23 and B7-19-21 for additional discusssion. In some cases, there is a level of supply slightly in excess of demand for an individual species/product. This is due to the production of a product at a level which helps satisfy demand for another product for which it is substitutable.

In some species/product groups, and particularly in the total timber volume, the level of output by alternative is nearly the same. This is due to a limit on demand. In other words, several or all of the alternatives may satisfy demand for a particular product or total timber. For example, demand for total timber is satisfied in the first two decades in alternatives 1, 4 and 7.

Table 4.23 dispays the estimated average annual revenues from timber in the first and fifth decade by alternative.

Table 4.23
Estimated Average Annual Timber Revenues in the First and Fifth Decade 1/

	Alternatives							
	1	2	3	4	5	6	7	8
	(thousand dollars)							
Average annual timber revenues (current level 915) 1/								
First decade	1,617	976	1,133	1,351	346	1,242	1,224	1,187
Fifth decade	4,951	4,539	4,744	4,841	2,773	4,403	4,723	4,640

1/ All figures are expressed in terms of 1978 dollars.

In all of the alternatives, a substantial increase in timber revenues would occur between the first and fifth decades. This is due to the increased output of timber along with increased demand for timber products as well as a general increase in the quality and value of timber produced from the Forest as the forest grows from a predominantly poletimber-sized forest to a predominantly sawtimber-sized forest.

All alternatives except alternative 5 produce slight to moderate increases in revenues compared to the current level (1980 to 1984). This is due to the increasing demand and quality of product as described above, expressed on a more short-term basis.

Some alternatives such as alternative 1 produce higher revenues than others. This is due primarily to the increased production in the higher valued products such as hardwood sawtimber and softwood sawtimber. Alternatives, such as alternative 3 that emphasize lower valued products, such as aspen, produce lower revenues.

Budget requirements for the first and fifth decades for vegetative management and local road construction for each alternative are shown in Table 4.24 along with current budget levels for those cost categories.

Table 4.24
Estimated Annual Budget Level for Vegetative Management and Local Road Construction in the First and Fifth Decade

Average Annual Cost by Cost Category	Alternatives 1	2	3	4	5	6	7	8
	(thousand dollars) 1/							
Vegetative management (current level = 1,222)								
First decade	1,163	1,027	1,087	1,086	651	1,198	1,187	1,117
Fifth decade	2,278	1,993	2,406	2,062	861	2,210	1,943	1,986
Local road construction (current level 355) 1/								
First decade	277	311	255	264	342	394	366	289
Fifth decade	230	272	198	208	101	183	162	188

1/ All dollars are expressed in 1978 terms.

First decade expenditures for vegetative management decline in all alternatives compared to current levels. This is due in part to the reduction in the reforestation-artificial practice in all alternatives.

The budget requirements for vegetative management are expected to roughly double in all alternatives from the first to the fifth decade. This is due to a general increase in vegetative management practices along with the increased demand for timber products.

However, the relative and absolute increases in cost are small compared to the increases in revenues between the first and fifth decades as discussed earlier.

All alternatives, except alternatives 6 and 7, have a reduced budget requirement for local road construction, compared to current levels. This is due to the reduced amount and standard of local road construction. Also, the budget requirements for local road construction will decline dramatically between the first and fifth decade in many alternatives. This is because the roads constructed in the early decades will also provide the needed access in later decades, and additional new local construction will therefore, decline substantially.

Wildlife

Cumulative effects on wildlife are derived from local road construction, some vegetation management practices, and wilderness designation.

Under all alternatives, new and existing local road closures will reduce the amount of local roads open to passenger vehicle use to 1 mile per square mile from September through December to provide habitat for wildlife species requiring remoteness.

Alternative 1 is predominately even-aged management with a diversity of vegetation species and forest age classes. Viable populations of wildlife are maintained. Management indicator

species are at or near current populations except that deer and grouse are slightly lower because a lesser amount of aspen is being managed. An adequate amount of thermal cover is available. This alternative offers a wide variety of conditions for small and big game hunting and nonconsumptive uses of wildlife.

Alternative 2 is a blend of even-aged and uneven-aged management with high levels of vehicular access. Compared to alternative 1, there is a slight increase in acres of managed aspen. Thermal cover is reduced in this alternative through conversion of thermal cover types to aspen and hardwoods. Viable populations are maintained. Bear are 10 to 20 percent less abundant as the Forest becomes more roaded and less remote. Deer and grouse populations are slightly lower than at present. Other management indicator species are at or near current population levels. Alternative 2 represents the habitat if current management practices were to be continued.

Alternative 3 is predominately even-aged with a diversity of vegetation species and forest age classes. Aspen is about as at present, more than with any other alternative. An adequate amount of thermal cover is available. There is the least amount of local roads of any alternative. Viable populations will be maintained; however, there is high risk for wildlife populations that nest in conifer types, such as the pine warbler. Deer and grouse populations are about as abundant as at present, being higher than with any other alternative. Other management indicator species should be at or near current population levels. Alternative 3 is considered as most responsive to concerns that deer and grouse habitat be maintained.

Alternative 4 is characterized by a modest amount of hardwoods managed even-aged with a large amount of semiprimitive recreation opportunity setting. Managed aspen is much reduced. There is a large amount of temporary openings from the emphasis on even-aged management of vegetation. An adequate amount of thermal cover is available. The road density is less than at present. Road closures limit hunter access compared to the present. Viable populations will be maintained. Deer and grouse populations are 10 percent less than present. Other management indicator species are at or near current population levels.

Alternative 5 does not maintain the aspen type nor provide young growth habitat. A continuous forest habitat is maintained through the harvest-selection management practice. Public access is high. Viable populations are maintained; however, there is high risk for populations associated with young growth habitats, such as spruce grouse, eastern bluebird, golden-winged warbler, and magnolia warbler. Deer, bear, and grouse populations are 10 to 20 percent lower than at present with declining amounts of thermal cover and loss of aspen and hardwood young growth habitat. Other management indicator species are at or near current population levels. This alternative is considered as least responsive in providing habitat conditions for deer and grouse.

Alternative 6 is predominately uneven-aged management of hardwood habitat, although there are a large amount of temporary openings. Aspen habitat is less than at present. An adequate amount of thermal cover is available. Viable populations are maintained. Grouse populations are 10 to 15 percent lower than at present as aspen declines in the forest composition. Other management indicator species are at or near current population levels.

Alternatives 7 and 8 are characterized by a blend of even-aged and uneven-aged management with a moderate amount of semiprimitive ROS class areas. A high amount of aspen habitat is managed, although total aspen acres are slightly less than at present. There is emphasis on aspen management in certain areas where hunters, deer, and grouse are historically higher, and where management of aspen is more effective in providing for public use of game species. An adequate amount of thermal cover is available. Viable populations of wildlife are maintained. In high wildlife opportunity areas, the emphasis on aspen, openings, thermal cover, and endangered and threatened species habitat protection and improvement should result in higher numbers of deer, grouse, osprey, and eagle.

Table 4.25 shows the probable direction of population trends for management indicator species if managed under each alternative. An arrow shows the probable direction of the population trend if the alternative were to be selected for the Forest plan. A dash indicates the species is not affected by vegetative management prescriptions in the alternative. Changes in effects of less than ±10 percent are not reflected in the matrix.

Table 4.25
Probable Direction of Population Trend of Management Indicator Species, Long-Term Outlook Through Decade 5

Species	Alternatives 1	2	3	4	5	6	7	8
White-tailed deer	→	→	→	↓	↓	→	→	→
Black bear	→	↓	→	→	↓	→	→	→
Common loon	→	→	→	→	→	→	→	→
American bittern	→	→	→	→	→	→	→	→
Ruffed grouse	→	→	→	↓	↓	↓	→	→
Osprey	↑	↑	↑	↑	↑	↑	↑	↑
Bald eagle	↑	↑	↑	↑	↑	↑	↑	↑
Goshawk	→	→	→	→	→	→	→	→
Barred owl	↑	↑	↓	↑	↑	↑	↑	↑
Blackburnian warbler	→	→	→	→	→	→	→	→
Brook trout	→	→	→	→	→	→	→	→
Smallmouth bass	→	→	→	→	→	→	→	→
Northern pike	→	→	→	→	→	→	→	→

This evaluation was developed in consideration of the amount and quality of habitat which would be under management by the end of decade 5:

- Trend projection for white-tailed deer, for each alternative, reflects anticipated changes in vegetative composition.
- Trend projection for black bear, for each alternative, varies inversely in response to roaded condition of the forest and directly in response to degree of vegetative disturbance.
- Trend projection for ruffed grouse, for each alternative, reflects anticipated changes in vegetative composition and age classes.
- Trend projection for bittern, for each alternative, is based on protection and improvement of wetlands under Forest standards and guidelines.
- Trend projection for osprey and bald eagle, for each alternative, is based on protection and improvement of endangered and threatened species habitat under Forest standards and guidelines.
- Trend projection for brook trout, for each alternative, is based on protection and improvement of cold-water stream habitat under Forestwide standards and guidelines.

- Trend protection for loon, bass, and pike, for each alternative, is based on protection and improvement of lake habitat under Forest-wide standards and guidelines.
- Trend projection for goshawk and blackburnian warbler, for each alternative, reflects anticipated changes in vegetative composition and age classes.

The trends shown above reflect expected conditions forest-wide. Populations of deer and grouse in High Wildlife Opportunity Area are expected to increase more than the 10% level which would show a change in Table 4.25 above. Osprey and eagle populations may, indeed, not increase to the objective level, however, sufficient territories to provide for this increase will be designated.

Refer to Final EIS Appendix Volume, Appendix F - Viable Population of Vertebrate Species for further information.

Endangered, Threatened, and Sensitive Species

Management direction does not vary by alternative in management of gray wolf, bald eagle and peregrine falcon habitat and would not vary for any species which may be included on the R-9 sensitive species list.

For the purpose of assisting in recovery of the gray wolf, an area of 256,000 acres of National Forest System lands and waters has been designated for special management along the southern portion of the Forest. The area is largely within a roaded natural motorized recreation area with added emphasis to maintain an open road density of less than one mile of open road per square mile in the area, and to aggressively manage vegetation to support a healthy population of deer as the principal prey of the wolf. This management involves closure of most newly constructed and some existing roads. This area was chosen to provide a "bridge" for natural immigration of wolves from Minnesota through northern Wisconsin into the Upper Peninsula of Michigan, bypassing to the north of populated Wisconsin River valley. The designated area has a history as wolf range.

For the purpose of assiting in recovery of the peregrine falcon, an area of 2,500 acres of National Forest System lands has been designated for special management within the Trap Hills area. This area was chosen because it contains a potential peregrine falcon nest site with a source of prey.

For the purpose of assisting in recovery of the bald eagle, all active and alternate nest sites in occupied breeding areas and nest sites in use within the past 5 years in unoccupied breeding areas have been designated for special management in so far as National Forest System lands and waters are involved. Special

zones of management are maintained surrounding each nest site to assist in maintaining the site free of any controllable disturbance that would adversely affect breeding activity. In addition, potential new breeding areas will be identified and protected.

Recreation

The cumulative effect on recreation settings results from local road construction and wilderness designation management practices, and is measured in terms of the mix of Recreation Opportunity Spectrum classes and the amount and location of areas recommended for wilderness designation or study that will be provided under each alternative. Refer to Forest Plan Appendix F-Recreation Opportunity Spectrum Explanation for more information and definitions of the ROS system.

Each management prescription represents a ROS class. As a result the amount of each ROS class in any alternative is directly linked to the acreage assigned to management prescriptions.

The management prescriptions and the ROS class each represented are listed in Table 4.26.

Table 4.26
Management Prescription and ROS Class Relationships

Management Prescription		ROS Class
1.1	=	Roaded natural
2.1	=	Roaded natural
3.1	=	Roaded natural
3.2	=	Roaded natural
4.1	=	Roaded natural
4.2	=	Roaded natural
5.1	=	Semiprimitive nonmotorized
6.1	=	Semiprimitive nonmotorized
6.2	=	Semiprimitive motorized
7.1	=	Roaded natural
8.1a	=	Semiprimitive nonmotorized
8.1b	=	Semiprimitive nonmotorozed
8.2	=	Roaded Natural and Semiprimitive nonmotorized
8.3	=	Roaded natural
8.4	=	Preservation
9.1	=	Semiprimitive nonmotorized
9.2	=	Semiprimitive nonmotorized
9.3	=	Roaded natural

Refer to Final EIS Appendix Volume, Appendix B-Description of Analysis Process, Part 3-The Forest Planning Model, management area prescriptions for a more complete description of each of the management area prescriptions listed in Table 4.26 above.

The amount of Forest area assigned to ROS classes by alternatives is shown in Table 4.27.

Table 4.27
ROS Classes by Alternatives

ROS Class	Current	Alternatives 1	2	3	4	5	6	7	8
				(thousand acres)					
Roaded natural	820	639	820	721	472	555	592	711	670
Semiprimitive motorized	-	141	-	55	272	216	167	51	102
Semiprimitive nonmotorized	106	146	106	150	182	154	167	164	154
(Acres of above SPNM recommended for wilderness study or designation)	(0)	(50)	(37)	(0)	(58)	(33)	(18)	(50)	(33)

Currently, the Forest has no ROS class semiprimitive motorized areas. In all alternatives except alternative 2, ROS class semiprimitive motorized recreation areas are provided ranging from a low amount of 51,000 acres under alternative 7, to a high amount of 272,000 acres under alternative 4.

Currently, the Forest has 820,000 acres of ROS class roaded natural area. Under all alternatives, ROS class roaded natural recreation areas are provided ranging from a high of 820,000 acres under alternative 2 to a low of 472,000 acres under alternative 4.

Semiprimitive nonmotorized ROS class area currently managed on the Forest totals 106,000 acres. Under all alternatives ROS class semiprimitive nonmotorized recreation areas are provided ranging from a high of 182,000 acres under alternative 4 to a low of 106,000 acres under alternative 2. Roadless areas recommended for wilderness study or designation are included in ROS semiprimitive nonmotorized areas. Refer to Roadless Areas under Part D of this chapter for the name and amount of roadless areas recommended for wilderness study or designation by alternative.

Economic

The cumulative effect on the economic environment of the Forest is measured in terms of change in employment, income, and payments to counties. These effects result, directly or indirectly, from the expenditures to create the benefits ranging from market products such as timber, to nonmarket recreation including hunting opportunities. The cash revenues generated and the budget requirements are also discussed.

Employment

The net effect on employment in the first decade by alternative is displayed in Table 4.28.

Table 4.28
Estimate of Forest-dependent Employment in the First Decade

	Alternative							
	1	2	3	4	5	6	7	8
	(jobs/year)							
Forest-dependent employment								
Assoc. w/ public use	1,536.5	1,426	1,470	1,634	1,574	1,552.2	1,469.2	1,508
Assoc. w/ timber products	457.5	334	408	456	100	372.2	446.8	415
Assoc. w/ Forest Service	124	123	125	121	105	128.6	135	124
Total	2,118	1,883	2,003	2,211	1,779	2,053	2,051	2,047

Depending upon alternative, the Forest is the basis for 7.9 - 9.6 percent (1800-2200 jobs) of total jobs in its impact area. The current trend (no-action) alternative produces 1900 jobs, and the others, range from minus 100 to plus 300 jobs in comparison with the current trend alternative. Total regional employment during the 1977 base year was 22,900 jobs per year.

Income

The net effect on total regional income in the first decade by alternative is displayed in Table 4.29.

Table 4.29
Estimate of Annual Forest-dependent Income in the First Decade

	Alternative							
	1	2	3	4	5	6	7	8
	(millions of 1978 dollars)							
Forest-dependent Income								
Assoc. w/ public use	20.2	18.7	19.5	21	20.56	20.3	19.3	19.7
Assoc. w/ timber products	7.7	5.7	6.8	8.2	1.6	6.3	7.6	7
Assoc. w/ Forest Service	2	2	2	2	1.8	2.1	2.2	2.15
Total	29.9	26.4	28.3	31.2	23.96	28.68	29.1	28.85

All alternatives would, according to the estimates above, account for at least 10 percent of regional income over the first 10 years. A group of alternatives comprising 1, 3, 4, 6, 7, and 8 would all exceed 10 percent. This would be a favorable addition to regional income in an area experiencing downturns in both income and employment in the recent past. Alternatives 2 and 5 would produce positive, but less significant contributions to the region's income level. Total regional income during the 1977 base year was $239 million.

Payments to Local Governments

Payments to local counties are estimated to be the same across all alternatives, and would approximate the average of payments made over the last five years. Refer to Final EIS, Chapter III, page 41.

Returns to Treasury

Returns to United States Treasury includes all Forest cash receipts. The majority of these come from timber sale revenues. Other receipts come from campground receipts, minerals and special use permits.

Table 4.30 shows the estimated annual returns to the federal treasury by alternative in the first and fifth decade.

Table 4.30
Average Annual Forest Receipts for the First Decade by Alternative

Average Annual Receipts (1980 to 1984)	Alternative							
	1	2	3	4	5	6	7	8
Current level 981	(thousand 1978 dollars)							
First decade	1,688	1,047	1,203	1,421	417	1,313	1,295	1,257
Fifth decade	4,951	4,621	4,826	4,923	2,856	4,486	4,723	4,723

All alternatives, with the exception of alternative 5, produce a gain in dollars returned to the federal treasury when compared with the average over the years 1980 to 1984.

Alternatives 1, 4, 6, and 7 produce significant increases in receipts when compared to the average. A second group made up of alternatives 2, 3, and 8 produce positive but less significant increases.

All the alternatives show roughly a four-fold increase in returns to treasury between the first and fifth decades. This is due primarily to the increased output and value of timber, along with increased demand for timber products. This increased revenue over time far outstrips the expected increases in budget, which is discussed in the following section.

Forest Budget

The estimated budget expense in the first and fifth decades, of each plan alternative is displayed in Table 4.31. Cost categories showing no significant change by alternatives, were grouped in the "other" category.

Table 4.31
Budget Level by Cost Category for the First and Fifth Decades by Alternative

Cost Category	Average Annual Budget (1980-84)	Alternative 1	2	3	4	5	6	7	8
					(thousands of 1978 dollars)				
Recreation									
First decade	449	342	402	425	356	432	342	437	432
Fifth decade		325	376	343	338	404	324	419	404
Vegetation management									
First decade	1,222	1,163	1,027	1,087	1,086	651	1,198	1,187	1,117
Fifth decade		2,278	1,993	2,406	2,062	861	2,210	1,943	1,986
Local road construction									
First decade	355	277	311	255	264	342	394	366	289
Fifth decade		230	272	198	208	101	183	162	188
Road Mtce., Collector Roads, Bridges, Dams and Facilities									
First decade	778	585	585	585	585	858	585	709	585
Fifth decade		528	528	528	528	528	528	528	528
Other									
First decade	1,084	1,478	1,478	1,478	1,478	1,478	1,478	1,478	1,478
Fifth decade		1,398	1,398	1,398	1,398	1,398	1,398	1,398	1,398
Total budget									
First decade	3,888	3,845	3,818	3,830	3,769	3,488	3,997	4,177	3,901
Fifth decade		4,774	4,567	4,873	4,562	3,292	4,643	4,450	4,504

In terms of total Forest budget, only alternative 5 is estimated to have a significant difference from the average annual budget

of the last five years. Other alternatives are within a range of $120,000 less to $110,000 more per year.

Variation between alternative recreation budgets is estimated to range between $342,000 and $432,000 reflecting differing levels of service to developed facilities. All are lower than the average annual current budget level.

Vegetation management costs are also estimated to drop on an annual basis in the first decade compared to the average annual budget level. The most significant cost variation on the table, vegetation management as part of alternative 5, shows the strong influence of restricting harvest methods to prohibit the existence of temporary openings caused by clearcuts or shelterwood cuts. This effectively eliminates the option of timber production on many Forest acres. This same restriction is the basis for the drop in returns to the treasury reported for alternative 5. Beyond this, alternatives 2, 3, 4, and 8 show the most significant decline in expenditures on vegetation management.

Budget expenditures on local road construction in the first decade were estimated to drop in comparison to the recent past, with the exception of alternative 6. Alternatives 5 and 7 were estimated to spend approximately the same amount on new road construction as over the last five-year average. All other alternatives dropped significantly, from 13 to 25 percent.

Almost all alternatives are estimated to have lower budget levels coupled with higher total cash receipts on average over the next decade than the average annual budget and revenue amounts of 1980 to 1984.

Alternative 1, when compared to the 1980 to 1984 period, shows an estimated 72 percent climb in cash receipts with a modest one percent drop in budget. Alternative 4, when compared to the same period, shows an estimated 45 percent climb in cash receipts over a three percent drop in budget.

The trends in total annual budget and budget by cost category can be determined by comparison of first decade and fifth decade estimates. Expenditures in recreation-related costs are expected to decline in future decades with the reduction in activities such as cultural resource surveys, trail construction, and wild/scenic inventory river studies. Most other recreation-related costs will remain about the same.

The real cost of vegetation management will nearly double in most alternatives between the first and fifth decades. This is due to the increased level of vegetation management practices along with the increased level of demand and output of timber products. The increased expenditures will be much lower than the increased revenues from timber.

The real cost of local road construction will decline over time. This is because many of the roads constructed in the early

decades will provide access to areas in the future, thus significantly reducing the need for additional new roads in future decades.

Although the total Forest budget would increase over time in all of the alternatives, the increase in revenues far outstrip these increased costs. In addition, the levels of nonmarket benefits are also expected to increase significantly over time, along with the increase demand for those benefits.

The cash revenues displayed above do not include those associated with possible future minerals production. Substantial mineral resources are known to exist on the Forest, but most of them are held by private corporations and individuals. In the case of minerals that are owned by the federal government, the timing of their development and the quantities that will be extracted are highly speculative. These economic values are not expected to differ significantly among alternatives.

It is important to note that the comparisons above only reflect cash receipts for forest "market" products. All alternatives produced other conditions and products designed to respond to public demands for forest uses. Many of these, like dispersed recreation, hunting, and fishing have an important effect on local and regional economics. While it is difficult to estimate, a value has been assigned to these products and is displayed as part of Chapter II of this document.

Additional detail on Forest budgets, costs by category, and anticipated revenues for each alternative is available in Forest planning records.

Social

A number of factors about the Forest and its management were identified as being of particular importance to various groups of Forest users. In this discussion, the alternatives are reviewed in light of these factors. No attempt is made to determine which alternative is best for individuals or groups. Instead, elements of the Forest thought to have an effect on these groups were identified. Sets of alternatives were defined as having more or less of those elements.

First, many of the factors defined as being of particular importance to many of these user groups are the same in all alternatives. Some of these factors were addressed in standards and guidelines for management developed for all plan alternatives. Many were included as part of program or fixed costs which do not vary by alternative.

The factors which do not vary by alternative are:
- Sale size and harvest practice,
- Cooperative law enforcement,
- Rights-of-way acquisition and/or special uses,
- Land adjustment for consolidation of ownership,
- Land adjustment for community and industrial expansion,

- Coordination of landownership adjustments with local units of governments,
- Conservation of soil and water resources and to avoid significant impairment of land productivity,
- Reconstruction and maintenance of bridges, major culverts, and collector roads,
- High quality developed and dispersed recreation facilities,
- Fishing habitat improvements where recreation developments exist,
- Study of wild/scenic inventory rivers,
- Completion of the North Country National Scenic Trail,
- Relocation and upgrading of existing segments of the Forest snowmobile/all-terrain vehicle trail system,
- Wildlife habitat and protection for endangered and threatened species.

Additional information about the factors above is available in the Forest Plan, Chapter IV, Forestwide standards and guidelines and the Final EIS Appendix Volume, Appendix B, Parts 4 and 8. Related cost information appears in Chapter II of this document.

Payments in lieu of taxes and increased employment opportunities and income were defined as being of particular interest to local governments. These factors are discussed under the Economics heading of this Part.

Maintaining critical habitat for endangered and threatened animals was defined as being of particular concern nationally. A discussion of these animals is presented in Chapter IV, Part D under the Endangered and Threatened Species heading.

The remainder of this section examines those factors that are affected differently by Forest Plan alternatives.

Timber Production

The following discusses the factor of providing an appropriate level of timber production as well as a variety of species and timber products. This was defined as being particularly important to the local and regional logging and forest products industry. The Forest has the capability of maintaining or increasing its contribution to the timber supply over the long term. This stable level of contribution is important as a source of supply now for jobs and as a future source around which the industry could grow.

All alternatives, with the exception of alternative 5, provide a level of total supply consistent with projected timber demand. Alternative 5 provides approximately 40 percent of projected demand.

Demand projections were also developed for aspen products and hardwood sawtimber. Using demand as a criteria, alternatives 3, 7, and 8 achieve the highest levels. The remaining alternatives provide about 50 to 60 percent. Hardwood sawtimber demand was satisfied in the first two decades in alternative 1 and 4. However, alternatives 6, 7, and 8 exceed current production levels on the Forest.

Alternatives 6, 7, and 8 most closely match the criteria of satisfying total demand as well as aspen and hardwood sawtimber demand.

Transportation System

The following discusses the factor of providing a transportation system that allows access to and efficient transportation of forest products to markets. This was identified as being particularly important to the local and regional forest logging and products industry. In a basic sense, a higher density of roads and a higher standard of road would permit greater accessibility and more efficient timber harvest and haul operations for wood producers. This would save operating time, increase the season of woods operations, and reduce wear on equipment.

Recreation opportunity spectrum (ROS) classes were used as a simple tool to measure density. Roaded natural, with the highest road density objective, carried 2.5 to 4 miles of road per square mile. Semiprimitive nonmotorized has the least density of up to 2.5 miles per square mile. On this basis, alternatives 2, 3, and 7 have the greatest overall density and accessibility across the Forest. A second group including 1, 5, 6, and 8 has a moderate degree of accessibility. Alternative 4, with an abundance of semiprimitive motorized and nonmotorized acres would have the poorest average accessibility.

In terms of road standards, the mix of road standards to be added to the system is nearly the same. From one alternative to the next, approximately 25 percent of all new local roads would be built to a winter-only standard with the remainder to higher standards providing greater operating seasons.

In addition, the roaded natural ROS class generally presents the fewest limitations to operators in terms of road closure or extended timber skidding distance in the woods.

On the basis of the discussions above, alternatives 2, 3, and 7 appear to have the greatest overall accessibility.

Road Access

Road access to the Forest was also identified as of particular interest to local hunters. Many local hunters fear that expanding the road system may spoil the remote character of the land in which they traditionally hunt. Some hunters see more roads as a means of extending their access to more acres of Forest land. On this basis, a mix of road density throughout the Forest would respond to both hunting interests.

Alternatives were defined as meeting this criteria in terms of ROS acreages. Again, roaded natural areas have a higher density objective with greater vehicle accessiblity. At the other end of the spectrum, semiprimitive nonmotorized areas have a low density of roads and greater controls on their vehicle access due to low standards and road closures. Alternatives 1, 5, 6, and 8 most closely match the criteria providing a wide mix of hunting environments.

Local road closures to provide quality hunting opportunities in nonmotorized settings are provided for in all alternatives during hunting season.

Habitat for Game and Nomgame Species

Providing habitat for game and nongame species was identified as being particularly important to a number of groups including visiting recreationists, recreation property owners, tourism, local residents, and national interest groups. The Forest has frequently been identified as offering a unique hunting environment. The remote settings, large deer, and absence of great numbers of hunters provides a special attraction for many. Maintaining, if not enlarging, the herd of white-tailed deer and numbers of ruffed grouse is frequently identified as desirable. On the basis of managed aspen type and conifer thermal cover as essential ingredients for maintaining these species, alternatives 3, 7, and 8 excel. These alternatives also emphasize aspen management in areas of the Forest having the highest habitat potential and hunter interest. Nongame species habitat, as represented by diverse vegetative conditions, include significant amounts of uneven-aged management.

Variety of Recreation Activities

Providing a variety of recreation activities was defined as particularly important to local and visiting recreationists, the tourism industry that serves them, rural residents, and national interest groups. If full-year season activities were defined as particularly important to the local tourism industry on the grounds that more diverse settings provide more and different opportunities, alternatives with a fairly balanced mix of ROS settings from roaded natural to semiprimitive nonmotorized were selected. These would allow a wide range of activities from easily accessible by car to remote walk-in settings. All alternatives have some of these components. Alternatives 1, 4, 6, and 8 provide a balance of settings followed by alternatives 1, 3, and 7. Developed and dispersed recreation facilities are managed essentially unchanged from one alternative to another providing campgrounds, boat landings, trails, and picnic grounds.

Visual Quality

Visual quality was identified as being particularly important to visiting recreationists, the local tourism industry and recreation property owners. The appearance the Forest gives to visitors helps define its appeal as a place to come for recreation and to purchase recreation property. High road densities, significant amounts of woods operations, particularly harvest-clearcut and harvest-shelterwood practices near or adjacent roads, developed recreation sites, lakes and rivers makes maintaining high visual quality difficult. Standards and guidelines have been designed to reduce the visual impact of these practices; however,their presence could still be felt. On this basis, alternatives with the fewest acres of harvest-clearcut and harvest-shelterwood, least road construction, and most acres of semiprimitive ROS classes and harvest-selection practice would have the least negative visual effect. Alternatives 4, 5, 7, and 8 most closely match that criteria.

Wilderness

Several national interest groups were identified as having a particular interest in the future of wilderness, its amount and location within the Ottawa National Forest. These groups have expressed interest in Sylvania, Sturgeon Gorge, and the Cyrus H. McCormick Experimental Forest. This group values adding National Forest System acreage in Michigan to the National Wilderness Preservation System. Currently, there are no acres in wilderness on the Forest or any of the National Forests in Michigan. The amount and location of roadless areas recommended for wilderness designation or study were defined as appropriate criteria for this interest.

Alternatives 1, 4, and 7 most closely match the criteria with between 50,000 and 60,000 acres of roadless areas recommended. Alternatives 2, 5, and 8 have a moderate amount of recommended acres, between 30,000 and 40,000 acres. Alternatives 3 and 6 have the least acres with zero and approximately 18,000 acres, respectively.

The effects alternatives have on the interests of various Forest users were built from examining a mix of characteristics and forest products on a Forestwide basis. Individual units on the Forest may exhibit characteristics and outputs not reflective of these Forestwide average assessments.

PART E. RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

This section describes how short-term uses, such as local road construction, wilderness designation or timber harvest, will affect long-term productivity of the physical and biological environment. The discussions are organized by environment elements which could be effected. Social and economic elements are not included, because only land and resources have the ability to produce goods, services and uses.

The overall relationship under any alternative is that it meets the requirements of the Multiple-Use Sustained Yield Act of 1960. This means "the achievement and maintenance in perpetuity of a high-level annual or regular periodic output of the various renewable resources of the national forests without impairment of the productivity of the land."

The production of most goods, services, and uses is maintained or increased while maintaining or enhancing long-term productivity.

Soil Productivity

Protection and management of the vegetation will maintain or improve soil productivity in the long term. Natural nutrient and organic matter recyling and prevention of accelerated soil erosion also contributes to soil productivity.

Minerals

Under all alternatives except alternative 3, some or all existing roadless areas on the Forest could result in wilderness designation. As a result the federally owned minerals would not be available.

Similarly, all federally owned minerals would not be available within proposed and established research natural areas.

Refer to Final EIS Appendix Volume, Appendix C-Roadless Area Evaluation, Appendix E-Research Natural Area Evaluation, and Part D of this chapter for more information about these areas.

Roadless Areas

In all but one of the alternatives, one or more of the inventoried roadless areas are recommended for wilderness study or designation.

The selection of an alternative that excludes any or all of the inventoried roadless areas from further study, would not necessarily mean that the area would not be protected against the loss of wilderness values. Those values can be protected and managed administratively as has been the case with the Sylvania, Sturgeon Gorge, and Cyrus H. McCormick Experimental Forest areas.

The potential to change the vegetative composition and natural characteristics of an area exists under some alternatives. Short-term uses of the land for harvesting or low standard road

building implies activities that temporarily alter the opportunity for solitude, challenge, and semiprimitive recreation pursuits.

Future management practices could be altered to allow roaded areas to reestablish wilderness attributes. Over time, roads can be obliterated and the vegetative features reestablished that convey characteristics of remoteness.

In summary, present decisions to select roadless areas for other than wilderness management, diminish opportunities for future inclusion in wilderness system. However, these opportunities could generally be recaptured in 50 years (unless high standard roads are involved), which is a period long enough to allow the natural landscape to cover up most human modifications.

Refer to Final EIS Appendix Volume, Appendix C-Roadless Area Evaluation and Part D-Roadless Areas in this chapter for more information about the roadless areas and the amount of area recommended for wilderness study or designation under all alternatives.

Timber Production

Short-term uses such as the protection of cultural resource sites, wild/scenic inventory river corridors, research natural areas, and roadless areas will limit the short-term production of timber products from the Forest.

The potential long-term productivity of these areas for timber production will not be affected. However, the permanent removal of some of these areas from timber production will limit the long-term sustained yield capacity of timber products from the Forest.

With the exception of the acreage of roadless areas recommended for wilderness or wilderness study, none of these other uses vary by alternative. The acreage of recommended wilderness designation or study by alternative is discussed in Chapter II and Part D - Roadless Areas in this chapter.

Construction of local roads removes narrow corridors of land from a forested condition. This practice however, provides access to areas for vegetative management to increase timber productivity, and provide improved conditions for timber producers to efficiently market their products.

In summary, the total area removed from actual production in any alternative is insignificant because most of the roads are in place. The positive effects largely outweigh the temporary vegetative effects and overall long-term productivity of the timber resource is enhanced.

Wildlife

Alternatives 2, 3, 4, and 7 provide long-term productivity increases in habitats of wildlife species associated with openings and young growth, with increases in management of aspen and even-aged management of hardwoods. These species are represented by white-tailed deer and ruffed grouse.

Alternatives 1, 4, 5, 6, 7, and 8 provide long-term productivity increases of habitats of wildlife species associated with mature forests, as these forests continue to develop from the present dominant poletimber condition. These species are represented by northern goshawk, barred owl, and blackburnian warbler.

Alternatives 1, 3, 4, 5, 6, 7, and 8 provide long-term productivity increases of wildlife species associated with remote forests, as local road construction is reduced and/or road closures are adopted. These species are represented by black bear.

Habitat for some wildlife species may decline in each alternative, but long-term productivity remains because viable populations will be maintained in each alternative (see Final EIS Appendix, Appendix Volume, Appendix F - Viable Populations of Vertebrate Species).

Endangered, Threatened, and Sensitive Species

Sufficient habitat for gray wolf, bald eagle, and peregrine falcon will be maintained to meet or exceed population objectives established for these species on Forest lands in all alternatives.

During preparation of the Forest Plan, a Regional guideline called for at least 15,000 acres of remote habitat per gray wolf pack for four potential wolf packs. All alternatives were designed to meet or exceed this original guideline. However, this guideline will soon be superseded by a new interagency policy calling for at least 64,000 acres of remote habitat per wolf pack. Forestwide standards and guidelines have been updated to reflect the new policy. Remote habitat as used here is an area that has a low density of roads open to public use, usually defined as an area which has less than 1 mile of road open to passenger vehicle use per square mile of area.

Recreation

The amounts of recreation activities by ROS settings, ranging from roaded natural to semiprimitive nonmotorized varies across the alternatives. Recommendations for wilderness designation or study make up part of this variation. Table 4.29, in Part D of this chapter displays the acreages of each ROS class.

In the future, if needed, management practices can be altered to allow areas to reestablish themselves for other ROS opportunities. For example, roaded natural areas can be allowed over time to recover the environmental characteristics which convey the feeling of remoteness.

Present decisions to assign acreages to the roaded natural ROS class can diminish future increases in semiprimitive ROS opportunities in the short term. However, these opportunities can generally be recaptured in 50 years or less, a period of time long enough to allow the natural landscape to cover human modifications such as low standard roads.

In conclusion, there is no long-term impairment of the capability of the Forest to produce a variety of recreation opportunities in various forest settings.

PART F. IRRETRIEVABLE OR IRREVERSIBLE COMMITMENT OF RESOURCES

This section describes the resources that will be irreversibly committed, because an area has been altered in such a way that it will be prevented from returning to its present condition for an extended period of time or because nonrenewable resources are used.

The section also describes the resources irretrievably committed because the opportunity to use them for some purpose is foregone for a period while they are being used for another purpose. The loss is sustained only during the period of their unavailability to the alternative uses.

Soil Resource

An irreversible effect on the soil resource is the amount of productive soil lost through road construction and borrow pits. Among the range of alternatives there is little variation and the impact is not considered significant.

Mineral Resources

Road construction and reconstruction are the most important practices affecting common variety minerals. Rating the alternatives in order of their common variety mineral consumption results in the following ranking of alternatives, from the highest amount of use to the lowest: 2, 3, 6, 7, 8, 1, 4, and 5. However, the range was 19 to 31 acres per first five decades for all alternatives.

Loss of potential production of federally owned minerals and acres of proposed and established Roadless and Research Natural Areas, see Table 4.15 in this Chapter.

Timber

There is loss of timber volume production in areas where active vegetation management is not the primary objective.

Timber production loss results when a given piece of ground under a management prescription is managed in a manner which severely reduces or precludes active vegetation management, such as management prescriptions 5.1, 9.1, 9.2, and 9.3.

Alternative 5 has the highest acreage removed from active vegetation management with successively lower amounts in alternatives 6, 1, 4, 7, 2, 8, and 3, with a range of 56,500 acres to 425,100 acres for all alternatives.

PART G. UNAVOIDABLE ADVERSE EFFECTS AND MITIGATION MEASURES

This section describes the adverse effects that cannot be avoided or completely mitigated. As discussed in Chapter II, whether an effect is adverse or positive is often a matter of personal opinion.

The effects were identified in the previous sections and are listed here. The effects will result from all alternatives unless otherwise noted. Mitigation measures are identified in the Forest Plan as part of standards and guidelines in Chapter IV. Part H in this chapter describes mitigation measures common to all alternatives. The following effects are not unacceptable; they are unavoidable in that they cannot be completely mitigated.

- Some erosion and sedimentation from soil disturbance due to road construction, skid trails, and landings.
- Alteration of natural landforms due to borrow pit development.
- Changes in visual quality, due to timber management and road construction for short durations, some of which may be objectionable to observers.
- Disruption or displacement of some recreation users and wildlife species due to timber management practices, road construction/reconstruction, and road closures.
- Long-term changes in recreation opportunities and wildlife diversity, to which some people may object.

These effects would be avoided if these practices were not used. However, the benefits which are provided by these management practices produce a high level of public goods and services which would be foregone. The value of the goods and services produced in each of the alternatives is far more significant than the unavoidable adverse impacts.

PART H. MITIGATION COMMON TO ALL ALTERNATIVES

This section discusses the mitigation provided by the alternatives. These measures were developed based on public issues and management concerns identified during the initial public involvement process and the comments received from public review of the Proposed Forest Plan (see Final EIS Appendix Volume, Appendix A). The standards and guidelines, including those based on the issues and concerns, are consistent with the management direction provided by the Regional Guide for the Eastern Region (9/83), Chapter 3. (See also Chapter 1, page 1 to 3.) The management prescriptions, including standards and guidelines, are contained in the Forest Plan, Chapter IV.

While the Forest Plan is the preferred alternative, the same management prescriptions are incorporated in all of the alternatives. Only the amount of land to which each management prescriptions will be applied varies between alternatives. The standards and guidelines and the mitigation measures incorporated

in them are an integral part of each alternative. This means they must be followed when implementing the alternative. Exceptions to this will be permitted only by amendment of the Forest Plan or when a separate environmental analysis shows a particular measure would not be effective in a given situation.

The environmental effects identified in this section are described relying upon the mitigation measures to avoid, reduce, or compensate for them so that they are not significant. Otherwise, the effects would have been considered significant. Those effects that cannot be sufficiently mitigated are discussed in the previous parts of this chapter.

The kinds of mitigation measures identified in the discussions below are only examples. In order to determine the full range of measures, the reader should review the standards and guidelines cited.

Soil Productivity

Road and trail construction, timber harvest, site preparation, prescribed burning, recreation use, mineral developments, road maintenance and closure, and wildlife habitat improvements can cause soil erosion, soil compaction, nutrient depletion, and soil displacement impacts to soil productivity.

In Part C of this chapter, the impacts caused by the vegetation management practices are largely short-term, nonsignificant impacts when mitigated by standards and guidelines.

Measures to mitigate these effects are stated in the Forest Plan, Chapter IV, as follows:

Subject	Direction	Resource Area
Mineral development	Forestwide	2500, 2800
Solid waste	Forestwide	7400
Site preparation	Forestwide	2100, 2400
Disturbed areas	Forestwide	2500, 2800
Roads	Forestwide	2400, 2500, 7700
Trails	Forestwide & Mgmt. prescriptions 1.1, 2.1, 3.1, 3.2, 4.1, 4.2, 5.1, 6.1, 6.2, 7.1, 8.1, 8.2	2300
Harvest	Forestwide vegetation	2400
Disturbed areas	Forestwide vegetation	2400, 2600
Disturbed areas	Mgmt. prescriptions 1.1, 2.1, 3.1, 3.2, 4.1, 4.2, 5.1, 6.1, 6.2, 7.1, 9.1, 9.2, 9.3	2300, 2500

Mitigation measures to maintain or enhance soil productivity by reducing or minimizing soil compaction, soil displacement, soil erosion, and nutrient depletion are contained in the standards and guidelines cited above. They include use of herbicides, location of trails, restoration of borrow areas, road closures, where to apply erosion control practices, design of soil and water resource improvement projects, design of road crossings, timely revegetation of exposed soils, location of roads, harvest operating periods, modification of whole-tree harvesting, location of landings, location of skid trails, modification of prescribed burns, and modification of mechanical site preparation.

Minerals

The practices of vegetation management will not cause significant changes to the existing conditions.

Visuals

Most of the vegetative management practices and local road construction can affect the visual resources by introducing evidence of human disturbance and not meeting Visual Quality Objectives. The measures to mitigate these effects can be found in the Forest Plan, Chapter IV, as follows:

Subject	Direction	Resource Area
Land and management planning	Forestwide	1900
Visual quality objectives	Forestwide	2300, 7700
Visual quality objectives	Forestwide and Mgmt. prescriptions 1.1, 2.1, 3.1, 3.2, 4.1, 4.2, 5.1, 6.1, 6.2, 7.1, 8.2, 9.1, 9.2, 9.3	2300, 2400, 2700
Landings and decking areas	Forestwide and Forestwide vegetation	2400

Management practices can be mitigated by the following measures included in the standards and guidelines cited above: proper location, screening, shaping, timing, residue treatment, retention of leave trees, uneven-aged timber management, use of native species and materials, maintaining cultural features, landscaping, and by limiting size of clearcuts and shaping clearcuts.

Mitigation measures will maintain, protect, or enhance visual quality as defined by visual quality objectives.

Cultural

Local road construction and vegetation management practices (harvest-clearcut, harvest-thinning, harvest-selection, harvest-shelterwood, reforestation-artificial reforestation-natural, release, and precommercial thinning) can disturb the ground surface sufficiently to damage or destroy cultural resource sites. Measures to protect cultural sites are found in the Forest Plan, Chapter IV.

Subject	Direction	Resource Area
Roads	Forestwide	2300
Harvest	Forestwide	2300
Reforestation	Forestwide	2300
Land exchange	Forestwide	2300

Effects of management practices on cultural resources are mitigated by avoiding the sites when applying the practices, or by removing and/or protecting/preserving cultural sites in accordance with existing laws and regulations.

Study of inventory information will improve understanding of the cultural resources and improve Forest Service ability to protect them. This will reduce the risk of inadvertent damage.

Fire

Prescribed burning and logging residue slash burning is used by the Forest Service to prepare some areas for tree planting and to eliminate slash and slash piles. Wildfire is not a major problem on the Forest.

Measures to mitigate the use of fire are found in the Forest Plan, Chapter IV.

Subject	Direction	Resource Area
Prescribed burning	Forestwide and Forestwide vegetation	2400, 5100
Suppression	Mgmt. prescriptions 5.1 and 9.1	5100

Riparian Areas

Construction of roads in streamside and lakeside areas results in alteration or loss of riparian values. Earth-moving activities, by removing organic matter, affects the sediment-filtering ability of the forest floor in riparian areas. The resulting sedimentation alters water quality. Clearing of riparian and stream or lakeside vegetation may also remove important wildlife habitat.

The natural functioning of floodplains can be altered by construction of facilities. Flow patterns may change or floodflows may be constricted and the flow velocity accelerated. Such changes could result in increased bank and channel erosion.

Timber harvesting and other vegetation management practices can significantly affect riparian area values. The construction of skid roads, log landings, and bridges disturbs the soil, and reduces the sediment-filtering ability of the forest floor. The removal of streamside overhead cover can increase water temperature. All of these adverse effects can be mitigated or eliminated by limiting the location of soil-disturbing activities within the riparian area and, when use of these areas is necessary, applying additional erosion control and sediment detention measures.

Location of local roads in proximity to riparian areas is guided by requirements spelled out in the standards and guidelines.

Appropriate mitigating measures that significantly reduce or eliminate sedimentation from timber harvesting operations include location of landings on nearly-level upland sites, provision of filter strips along streams, placement of skid trails on contours, placement of water bars and seeding on roads and trails, and avoiding soil loss at stream crossings by use of appropriate structures such as bridges, culverts, and approach protection.

The standards and guidelines discussed above may be found in the Forest Plan as follows:

Subject	Direction	Resource Area
Site preparation	Forestwide	2400
Vegetation	Forestwide and Forestwide vegetation	1900, 2400
Wetland values	Forestwide	2600, 5400
Floodplain values	Forestwide	5400
Roads	Forestwide	2500, 7700
Stream crossings	Forestwide	2500
Harvest	Forestwide	2500

Water Quality

Road development may affect water quality indirectly by altering the natural drainage system. These changes result in greater volumes of runoff reaching streams faster, allowing for the removal and transport of larger quantities of sediment.

Local road construction has the potential for causing significant effects on local surface water resources. Construction, reconstruction, and the continued maintenance of roads creates a condition of soil exposure. As the exposed soil is subjected to rainfall, erosion occurs. The transport of eroded soil as sediment into streams, ponds, and lakes can cause deteriorated water quality. Naturally occurring events such as low-frequency floods and landslides also can cause a large temporary increase in sedimentation.

The amount and type of groundcover, obstructions, and distance, up to a point, affect potential sedimentation of streams and lakes by disturbance. The potential for sedimentation of lakes and streams increases the closer disturbed areas are to water. The greatest potential for erosion and sedimentation is improperly located log landings and logging roads.

While the cutting of trees has no effect on physical water quality, the removal of forest products from the woods by skidding and truck hauling can adversely affect water quality. The forest floor is disturbed and compacted where skid trails, skid roads, log landings, and haul roads are located. Unprotected mineral soil is exposed and is subject to wind, rain, and surface runoff. The potential for erosion increases as the slope of the land increases and as the area being disturbed increases.

Timber harvesting practices can have a small but measurable effect on chemical water quality. A considerable amount of research has been done in the past few years with regard to the effects of clearcutting on the release of nutrients into streams. The preponderance of evidence, both from research studies in areas of similar soils, topography, and forest cover, and from monitoring done by the Forest Service indicates that nutrient increases are not significant and are of short duration.

The measures discussed above are found in the Forest Plan, Chapter IV, as follows:

Subject	Direction	Resource Area
Site preparation	Forestwide	2100
Disturbed areas	Forestwide	2500
Disturbed areas	Mgmt. prescriptions 1.1, 2.1, 3.1, 3.2, 4.1, 4.2, 5.1, 6.1, 6.2, 7.1, 8.1, 8.2	2300, 2500
Mineral development	Forestwide	2500
Solid waste	Forestwide	2500
Vegetation management	Forestwide and Forestwide vegetation	1900
Water supply	Mgmt. prescriptions 1.1, 2.1, 3.1, 3.2, 4.1, 4.2, 5.1, 6.1, 6.2, 7.1, 8.1, 8.2, 9.1, 9.2, 9.3	7400
Roads	Forestwide	2500, 7700
Roads	Forestwide and Forestwide vegetation	2400
Trails	Forestwide	2300
Trails	Mgmt. prescriptions 1.1, 2.1, 3.1, 3.2, 4.1, 4.2, 5.1, 6.1, 6.2, 7.1, 8.1, 8.2	2300

Appropriate mitigating measures that significantly reduce or eliminate sedimentation from timber harvesting operations include adding water bars to skid and temporary haul roads; revegetating roads; controlling the size, shape, and location of clearcuts; curtailing logging operations during wet weather; and leaving filter strips.

Air Quality

The practices of local road construction, vegetation management, and wilderness designation would not cause any significant changes to the existing conditions.

Noise

The practices of local road construction, some timber harvesting, and reforestation preparation involve the use of heavy equipment that produces noise. Impacts of noise on the Forest visitors and local communities can be reduced by limiting these practices to certain times of the year when few visitors are in the Forest and by locating the practice considering those people who live in the communities within the Forest.

Subject	Direction	Resource Area
Environmental management	Forestwide	2100
Recreation	Mgmt. prescriptions 1.1, 2.1, 3.1, 3.2, 4.1, 4.2, and 7.1	2300

Wild/Scenic Inventory Rivers

The practices of local road construction, vegetation management, and wilderness designation will not cause any significant changes to the existing conditions of these potential wild/scenic rivers because these practices are not allowed in these areas until after they are studied and their future designation decided.

Research Natural Areas

No management practices are allowed in research natural areas under any alternative.

Roads

The practice of vegetation management would not cause any significant changes to the existing conditions.

Wildlife

Harvest-thinning, release, and precommercial thinning tend to produce uniformity within timber stands, to favor commercial species of the greatest value, and to create stands of about the same size and timber quality. Wildlife species that feed on insect-ridden trees, that nest in tree cavities, or that seek some other specialized habitat that does not meet tree quality standards may not do well under these practices. Measures to maintain certain within-stand diversity may be needed. Mitigation measures to ensure maintenance of a diversity of habitats are found in the Forest Plan, Chapter IV, as noted below:

Subject	Direction	Resource Area
Management indicator species habitat objectives	Forestwide	2600
Vegetation management	Forestwide vegetation	1900, 2400
Silvicultural practices	Forestwide vegetation	2400
Vegetation composition	1.1, 2.1, 3.1, 3.2, 4.1, 4.2, 6.1, 6.2	2400

These measures include such things as providing for retaining older overstory trees in some of the stands if existing older tree condition is scarce. Also, composition objectives and habitat objectives are to be worked for and spatial distribution of types and age classes is to be considered.

Fish

Local road construction can impact stream fish habitat either by altering stream flows through culverts or under bridges or by concentrating water runoff which accelerates erosion. Either of these can seriously impact fish spawning and the quality of fish habitat.

Mitigation measures to eliminate or significantly reduce the effect of local road construction on stream habitat are found in the Forest Plan. These measures include such things as direction to avoid riparian areas in locating new roads, if possible. If riparian areas must be entered, there are ways in which disturbance to fish habitat can be eliminated or otherwise kept under control.

Management practices that regenerate aspen are to be modified if located adjacent to certain trout streams so as to avoid encouraging habitat attractive to beaver. Mitigation measures to ensure these effects are found in the Forest Plan. These aim to reduce the growth of aspen adjacent to quality trout streams.

Wilderness designation may specify limitations of access that could effect the cost or effectiveness of fish management in lakes within the wilderness. Mitigation measures to ensure protection of wilderness values are found in the Forest Plan.

Subject	Direction	Resource Area
Coordination	Forestwide	2600
Road crossings	Forestwide	7700
Preserve lakes	Forestwide	2500
and streams	Forestwide vegetation	2400
Water temperatures in streams	Forestwide vegetation	1900
Preserve wilderness	Mgmt. prescription 5.1	2600

Endangered, Threatened, and Sensitive Species

Several effects of management practices could occur regarding essential habitat of bald eagles. Inadvertent disturbance during the nesting season could occur because of human activity, such as road construction, harvest of timber, or transportation of forest products, on lands adjacent to active nests. Occasionally, direct harassment of nesting eagles is reported.

Mitigation measures are contained in the Forest Plan, Chapter IV, for use within areas managed to support recovery of the bald eagle, peregrine falcon, and gray wolf.

Subject	Direction	Resource Area
Habitat objectives	Forestwide	2600
Coordination	Forestwide	2600
Endangered, threatened, and sensitive species	Forestwide	2600
Land exchange	Forestwide	5400
Road closure	Forestwide	7700

Recreation

Effects on recreation that are caused by vegetation management are mitigated by procedures, such as relocating trails to avoid sale areas and local roads, locating and shaping sale areas to avoid use areas or to enhance views from the use areas, scheduling cutting to avoid busy recreation periods such as weekends or hunting seasons, and designing local roads to reduce conflicts with recreation traffic.

The measures to mitigate effects on recreation are found in the Forest Plan, Chapter IV, as indicated below:

Subject	Direction	Resource Area
Recreation Opportunity Spectrum	Forestwide	2300
Roads	Forestwide	2300, 7700
Vegetation management	Forestwide and Forestwide vegetation	1900
Recreation Opportunity Spectrum	Mgmt. prescriptions 7.1, 8.2	7700
Vegetation management	Mgmt. prescriptions 1.1, 2.1, 3.1, 3.2, 4.1, 4.2, 6.1, 6.2, 7.1, 8.2, 9.1, 9.2	2300, 2400

PART I. MONITORING AND EVALUATION

The purpose of monitoring and evaluation is to determine progress toward meeting Forest Plan direction. Monitoring and evaluation are separate, sequential activities. They provide information to determine whether Forest Service programs are meeting the Forest land and resource management plan direction. This direction includes goals and objectives, management prescriptions, and standards and guidelines. It is through this process that the quality of implementation is assessed. Any needed changes in the Forest Plan management direction are determined through this process. Chapter V of the Forest Plan describes the monitoring and evaluation program.

Monitoring

Monitoring is done to observe or record the results of actions. This consists of collecting information from selected sources on a sample basis. Information is used to determine:

- If Forest Plan goals and objectives are being achieved.
- If management area prescriptions are applied as directed.
- If the results of applying prescriptions address the management problems, issues, concerns, and opportunities.
- If costs of implementing the Forest Plan are as predicted.

Items to be Monitored

Following is a list of the activities, practices, outputs, and effects to be monitored:

Transportation (Management Problem 1)

- Local road densities and mix of standards.

Wildlife (Management Problem 2)

- Coordination with Michigan DNR.

Wildlife and Vegetation Management (Management Problems 2 and 4)

- Maintained aspen.
- Maintained and unmaintained thermal cover.

Landownership (Management Problem 3)

- Land adjustment program.

Vegetation Management (Management Problem 4)

- Use of chemicals.
- Uneven-aged versus even-aged management of northern hardwood.
- Comparison of outputs/services with those projected in Forest Plan.

- Documentation of measured prescriptions/effects, including significant changes in productivity of the land.
- Documentation of actual cost of practices in relationship to estimated costs.
- How well management prescriptions, practices, standards, and guidelines have been applied on the ground.
- Documentation that lands are adequately restocked as specified in the Forest Plan.
- Documentation that lands identified as not suited for timber production are examined at least every 10 years and, if suited, are returned to timber production.
- Insects and disease damage.
- Maximum size limits for harvest areas as specified in management area prescriptions, standards, and guidelines.
- Effects of National Forest management on adjacent lands and effects upon National Forest System lands by other government agencies.
- Research needs to support or improve National Forest management.
- Wildlife population trends of the management indicator species.
- Federally listed endangered species to protect, maintain, and/or enhance principal habitat(s) to achieve recovery objectives.

Evaluation

Evaluation is the analysis and appraisal of the observations made during the monitoring process. Evaluation determines how well the results meet the Forest Plan direction. From this evaluation, the Forest Service will decide what changes are necessary to ensure that management activities conform to the Plan.